INSTRUMENTATION LABORATORY
DEPARTMENT OF ELECTRICAL ENGINEERING
UNITED STATES AIR FORCE ACADEMY, COLORADO

NASA CR-141883

ANALYSIS OF CHANGES IN LEG VOLUME PARAMETERS, AND ORTHOSTATIC TOLERANCE IN RESPONSE TO LOWER BODY NEGATIVE PRESSURE DURING 28-DAYS EXPOSURE TO ZERO GRAVITY SKYLAB 2

RICHARD D. BARNETT

RICHARD J. GOWEN, LT COL, USAF

DAVID R. CARROLL, MAJOR ,USAF

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N75-33641

Unclas 39000

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The prototype development and calibration of the Limb Volume Measuring System (LVMS) for the Skylab Missions was performed in the Instrumentation Laboratory of the Department of Electrical Engineering at the United States Air Force Academy. This report discusses the final processing and analysis of the leg volume data for Skylab Mission 2. This work was supported under NASA Project Number T66344(G).

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INTRODUCTION

The design of the leg volume measuring system employed for the M092 portion of the Skylab Missions required the development of a system sensitive to large and small volume changes at the calf of the leg. These changes in volume were produced in response to the orthostatic stress of a Lower Body Negative Pressure Device (LBNPD) or by venous occlusion.

The prototype capacitive plethysmographs were designed at the U.S. Air Force Academy and were space qualified by the Martin-Marietta Corporation for use on the Skylab Missions. The design and evaluation of this type of measuring system has been described previously (1, 7, 8).

The operational efficiency of the Leg Volume Measuring System (LVMS) was additionally verified during the 56-day simulation of Skylab environment at 1-G (Skylab Medical Experiments Altitude Test) (9). The capacitive plethysmographs were used in conjunction with the M092 Lower Body Negative Pressure test to obtain baseline physiological data. A capacitive plethysmograph must be initially calibrated to establish the correlation between the change in capacitance and the change in volume of the segment being monitored. The devices and techniques used to obtain the calibration data for the seventy-six Skylab leg bands have been described in a previous technical report (2).

In addition to the calibration of the LVMS, specific signal processing was also performed at the Air Force Academy. A previous technical report (3) described the system, techniques and algorithms used for signal processing performed in the Instrumentation Laboratory.

The cardiovascular responses of the Apollo crewmen associated with the postflight evaluations indicate varying decrements of orthostatic tolerance. The postflight changes indicate a slightly diminished ability of the cardiovascular system to function effectively against gravity following exposure to weightlessness. The objective of the Skylab LBNP experiments (M092) was to provide information about the magnitude and time course of the cardiovascular changes associated with prolonged

periods of exposure to weightlessness. This report details the equipment, signal processing and analysis of the leg volume data obtained from the M092 experiment of the Skylab 2 Mission.

METHODS AND MATERIALS

The preflight baseline data were acquired prior to flight at varying intervals up to four and one-half months before launch. In-flight tests were performed at approximately 3-day intervals while postflight data were collected at increasing intervals of time over a period of several months. Tables 1 and 2 indicate the chronology and number of the M092 tests conducted on each astronaut of the Skylab 2 Mission.

Experiment Hardware

The M092 experiment hardware consisted of the Lower Body Negative Pressure Device (LBNPD), the Limb Volume Measuring System (LVMS), a Blood Pressure Measuring System (BPMS), a Vector Cardiograph System (VCS) and a Body Temperature Measuring System (BTMS). An Experiment Support System (ESS) provided power and controls for operation and calibration of the hardware. This report will be restricted to a discussion of the leg volume changes except where discussion of other cardiographic parameters help explain or clarify the changes in leg physiology.

a. LBNPD. The lower body negative pressure device used for testing orthostatic tolerance was cylindrical in shape and constructed of anodized aluminum. Adjustable iris-like templates at the open end of the device formed to body contours at the level of the waist. An adjustable padded saddle allowed longitudinal positioning such that the iliac crests were located at the level of the metal iris plates. The final component of the waist seal was a zippered, pliable, contoured sheet of fluorel impregnated beta cloth which was fastened around the waist with velcro fasteners. The LBNPD is shown in Figure 1 in the open position to allow attachment of leg volume sensors. The negative pressure was

TABLE 1. CHRONOLOGY OF M092 LOWER BODY NEGATIVE PRESSURE TESTS DURING PREFLIGHT, IN-FLIGHT AND POSTFLIGHT PERIODS OF SKYLAB 2.

Commander				Scientist Pilot				Pilot			
Run No.	Jul Date	Mis Day	Expr Code	Run No.	Jul Date	Mis Day	Expr Code	Run No.	Jul Date	Mis Day	Expr Code
1	357	F-153	1	1	357	F-153	1	1	357	F-153	1
2	25	F-120	1	2	26	F-119	1	2	30	F-115	1
3	61	F-84	1	3	57	F-88	1	3	57	F-88	1
4	78	F-67	1	4	78	F-67	1	4	78	F-67	1
5	106	F-39	1	5	106	F-39	1	5	106	F-39	1
6	131	F-14	1	6	131	F-14	1	6	131	F-14	1
7	149	5	2	7	149	5	2	7	148	4	2
8	153	9	2	8	154	10	2	8	151	7	2
9	156	12	2	9	157	13	2	9	155	11	2
10	160	16	2	10	161	17	2	10	159	15	2
11	163	19	2	11	164	20	2	12	165	21	2
12	166	22	2	12	167	23	2	13	168	24	2
13	169	25	2	13	169	25	2	14	171	27	2
14	173	R+0	3	14	173	R+0	3	15	173	R+0	3
15	174	R+1	3	15	174	R+1	3	16	174	R+1	3
16	175	R+2	3	16	175	R+2	3	17	175	R+2	3
17	177	R+4	3	17	178	R+5	3	18	178	R+5	3
18	181	R+8	3	18	181	R+8	3	19	181	R+8	3
19	187	R+14	3	19	187	R+14	3	20	186	R+13	3
20	193	R+20	3	20	197	R+24	3	21	194	R+21	3
21	236	R+63	3	21	236	R+63	3	22	236	R+63	3

TABLE 2. M092 LOWER BODY NEGATIVE PRESSURE TESTS DURING SKYLAB 2.

	Preflight	In-flight	Postflight	Total
Commander	6	7	8	21
Scientist Pilot	6	7	8	21
Pilot	6	8	8	22
	18	22	24	64

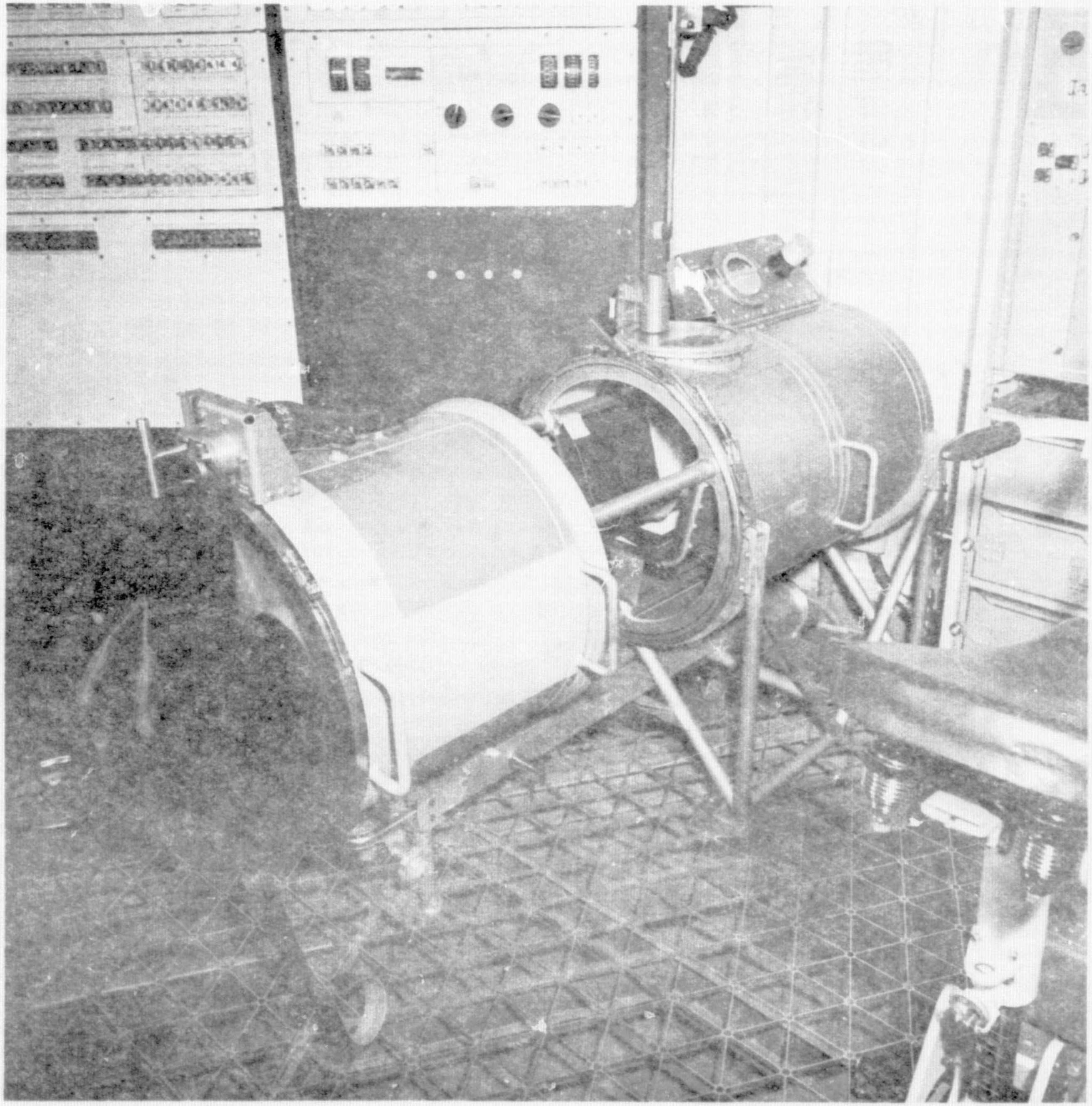

FIGURE 1. THE LOWER BODY NEGATIVE PRESSURE DEVICE (LBNPD).

provided by a vacuum plenum or, during flight, by the vacuum of space, and a manual valve was used to control the decrement of pressure within the device. In case of emergency a quick-release valve was used to vent the chamber to ambient pressure. Temperature sensors were located both internal and external to the LBNPD to provide LBNPD temperature and ambient temperature.

b. Limb Volume Measuring System (LVMS). The limb volume measuring system was designed to measure the volume changes occurring at the calf in response to a lower body negative pressure test or venous occlusion. The magnitude and time course of the leg volume response was used to provide an indication of changes in vascular physiology associated with an altered cardiovascular status. The type of capacitive plethysmograph used on the Skylab Mission is shown in Figure 2. The operation of the plethysmographic sensors has been described in considerable detail in previous technical reports (1, 2, 7, 8). Basically, the sensors function by transducing the change in capacitance between parallel plates (skin and measuring plate) and relating the change in capacitance to a change in volume. The transformation to percent change in volume is accomplished in reference to the initial calibration of the plethysmograph and the calibration plates which are internal to the leg band. Each plethysmograph sensor contains its own electronic module, calibration plates, a spiral torsion spring, foam separation material, measuring band and shield as shown diagrammatically in Figure 3. Each sensor is adjustable through a one-inch range of calf circumference with utilization of the same calibration number over that range. A list of the plethysmographic sensors available for the Skylab mission with their range, calibration value and output voltages are tabulated in Appendix A. The operation of the LVMS required that the astronaut establish the proper sensor gain by adjusting null and gain potentiometers located on the ESS to achieve the current calibration number as indicated by the ESS-LVMS displays.

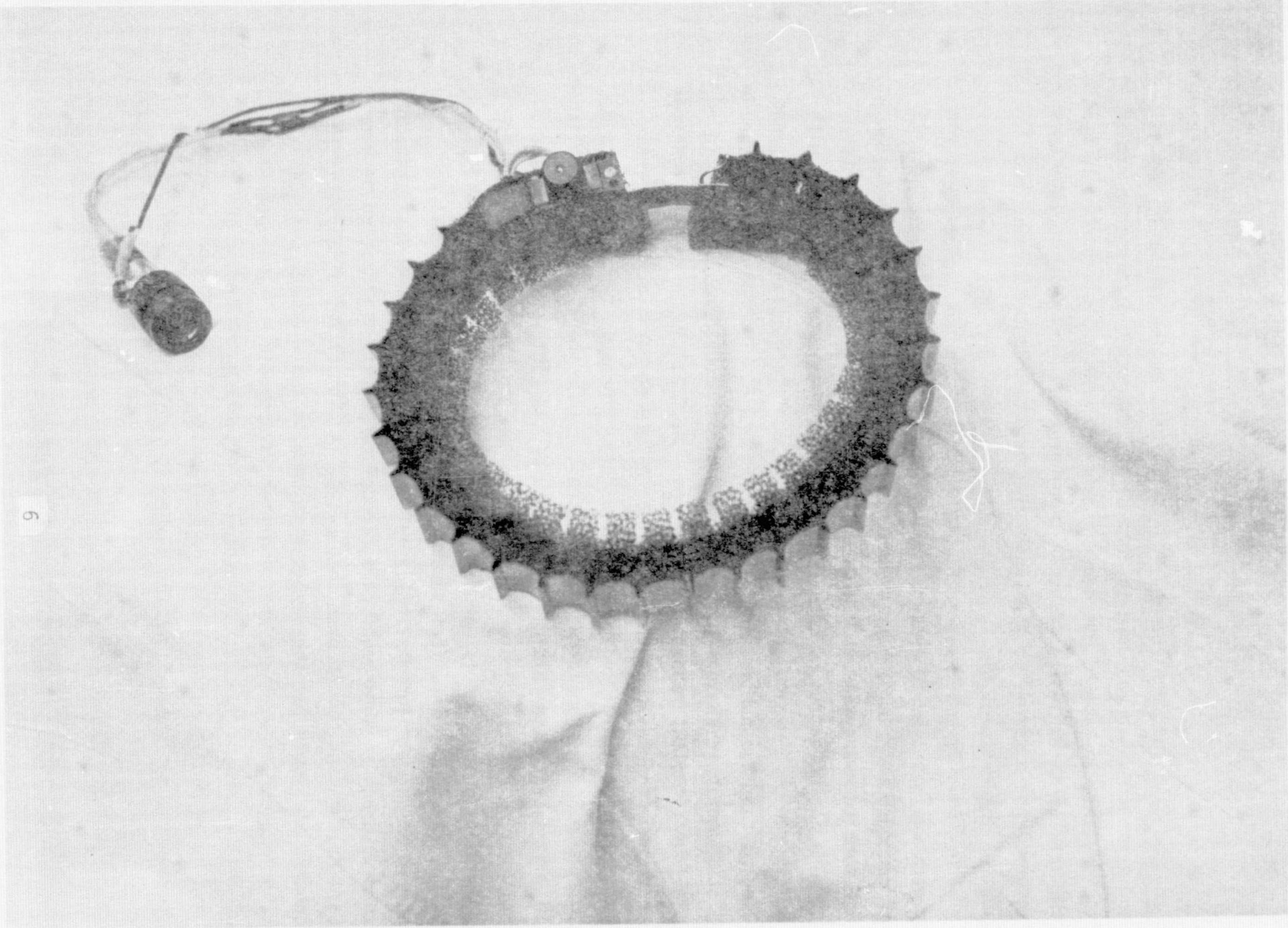

FIGURE 2. CAPACITIVE PLETHYSMOGRAPH USED ON SKYLAB FOR MEASUREMENT OF VOLUME CHANGE AT THE CALF.

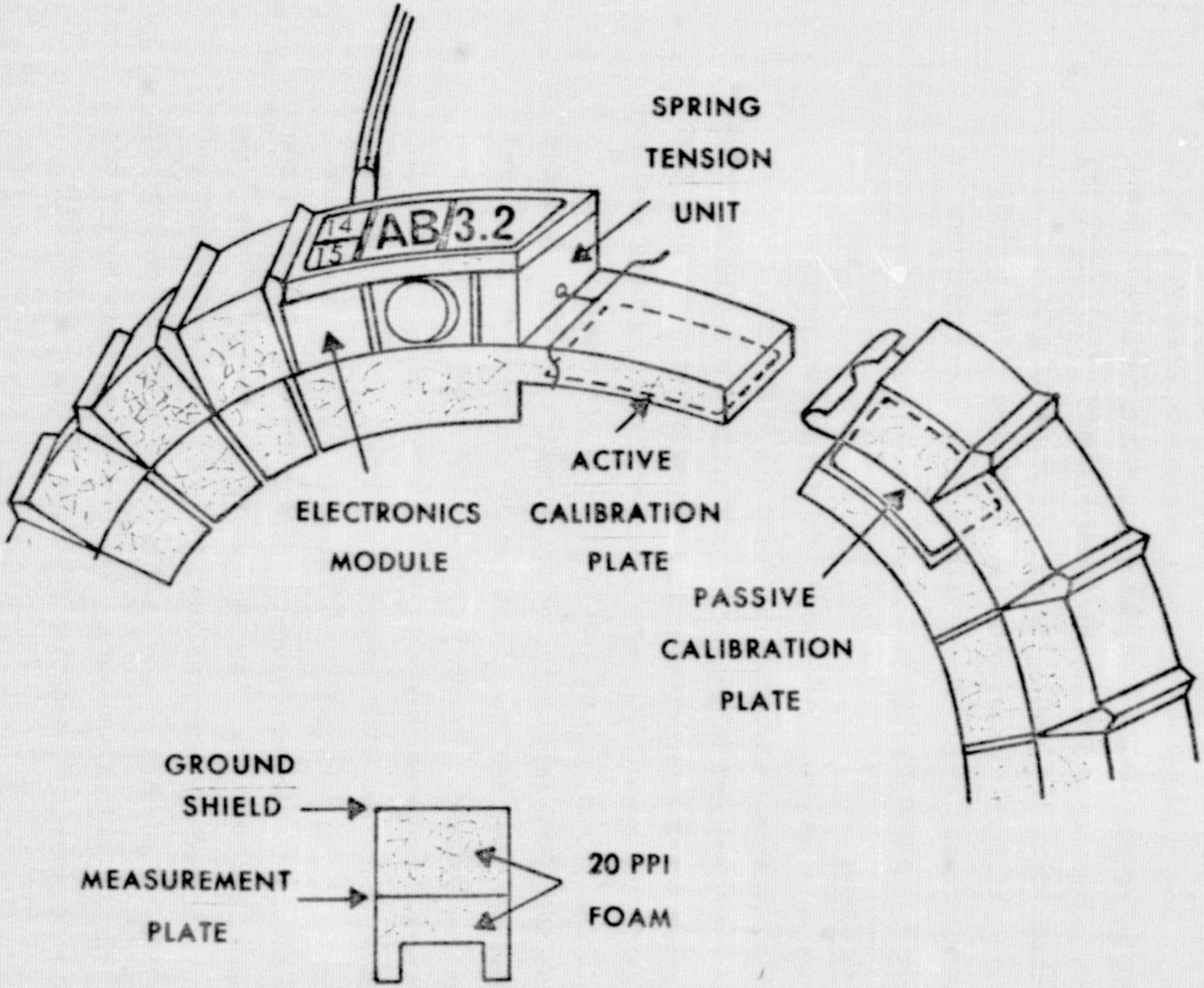

FIGURE 3. DIAGRAMATIC REPRESENTATION OF THE COMPONENTS OF THE CAPACITIVE PLETHYSMOGRAPH

In operation, two plethysmographic sensors are placed on the subject as shown in Figure 4. The sensor on the left leg measures the change in volume at the left calf and is also responsive to changes in temperature and humidity within the LBNPD. The sensor on the right leg is placed over a stainless steel cylinder or reference adapter in contact with the skin. This cylinder or reference adapter insures that the right leg band is responsive only to temperature and humidity changes in the chamber. Thus, by using the difference signal (i.e., left leg band output minus right leg band output), data could be produced which was unaffected by changes in environmental conditions. The typical output from the left and right leg bands as well as the difference or corrected signal is shown in Figure 5.

Experiment Procedures

Provisions were made to allow sufficient time between physical exertion, meals, showers or venipunctures and the LBNP test. Preparations for the test included instrumenting the subject with the modified Frank lead system for the recording of the Vectorcardiogram. With the subject supine in the open LBNPD, both calf circumferences were measured to the nearest one-eighth inch at the location of the maximum girth. After securing the LBNPD seal, knee and ankle restraints were fastened and the plethysmographic sensors of the proper size were installed and their calibration checked. The BMPS cuff was attached to the left arm and VCG electrode impedances were checked. Figure 6 shows a subject fully instrumented for the M092 Lower Body Negative Pressure experiment. Preceding and following each test, calibration values for heart rate, systolic and diastolic blood pressure, left and right leg volumes, and VCG were checked and recorded. The LBNP protocol shown in Figure 7 was identical to that used for the preflight and postflight experiments. The first and last 5 minutes of the 25-minute protocol were control and recovery periods at ambient pressure. The 15-minute stress period consisted of five decrements in negative pressure applied sequentially.

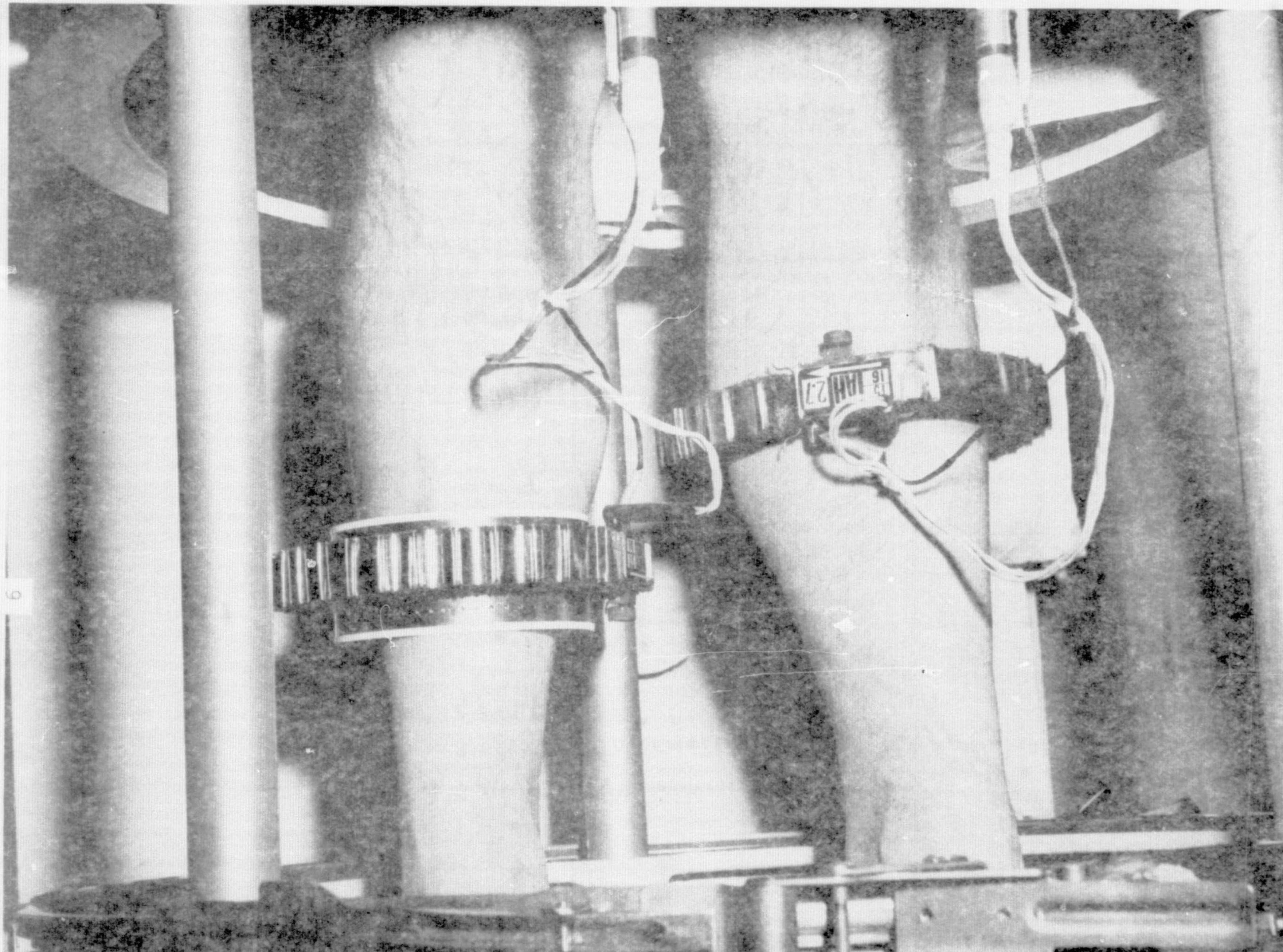

FIGURE 4. POSITION OF THE PLETHYSMOGRAPHS ON THE LEGS FOR VOLUME MEASUREMENTS DURING SKYLAB.

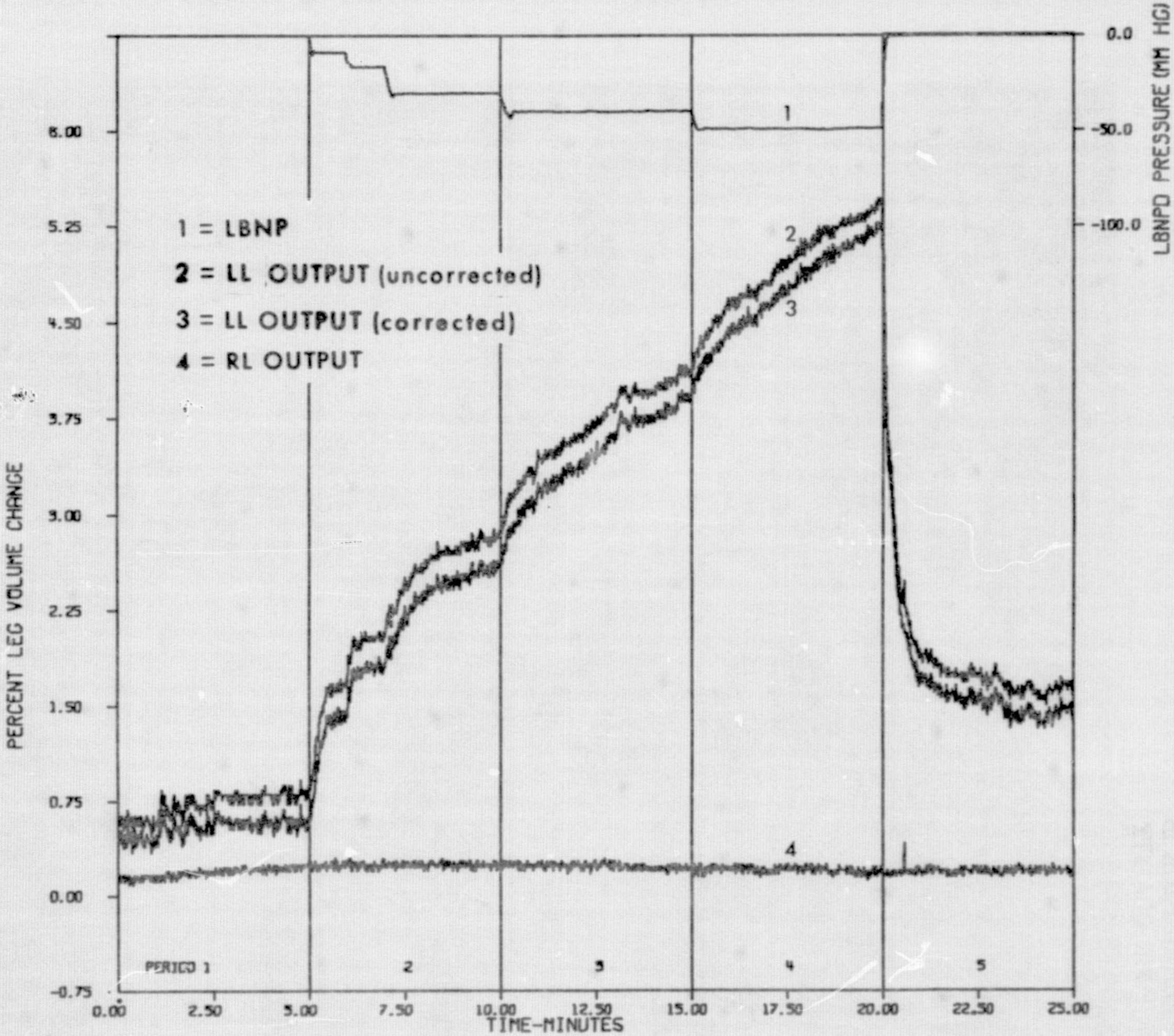

FIGURE 5. OUTPUT PARAMETERS FROM M092 EXPERIMENT.

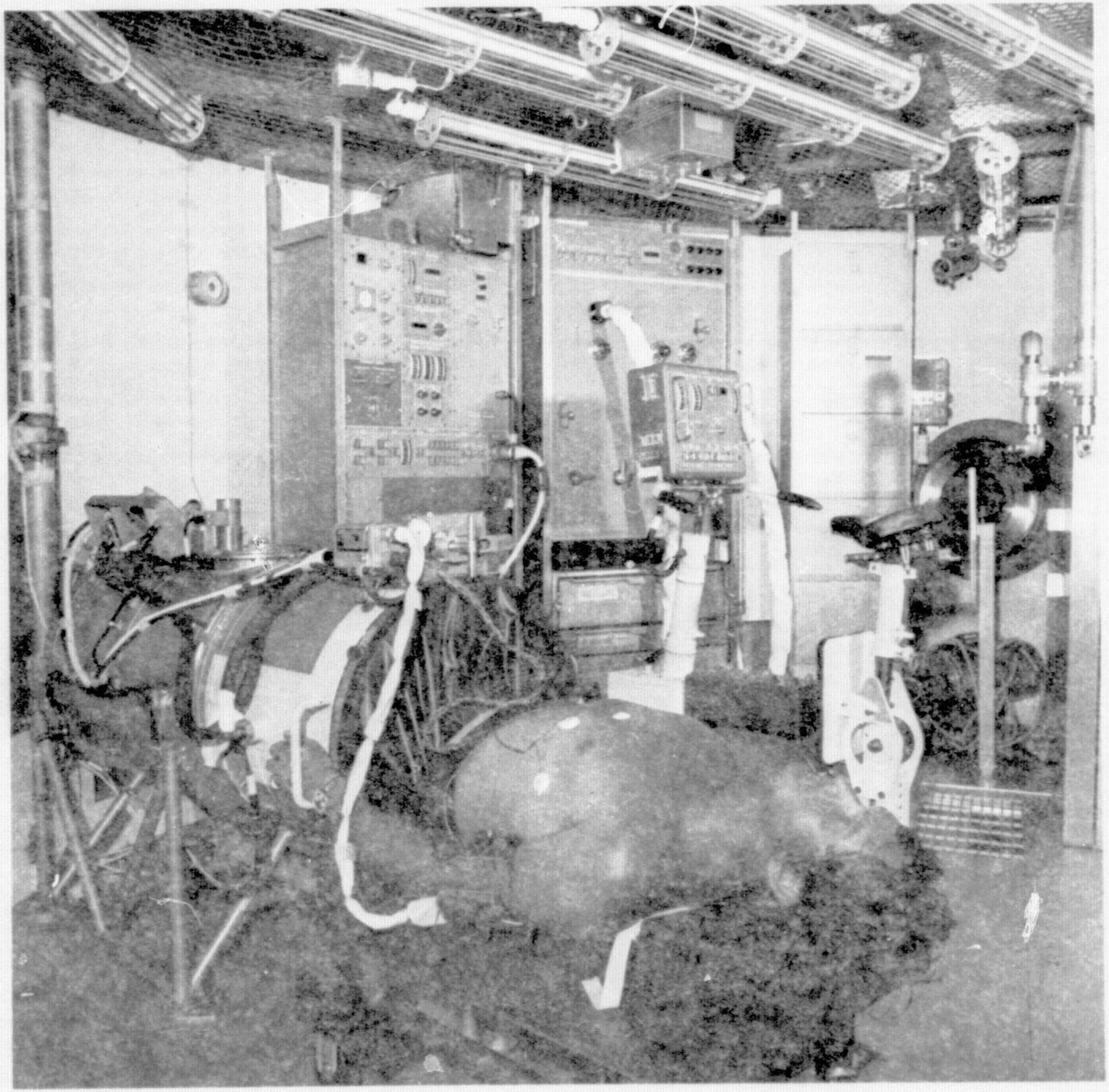

FIGURE 6. SUBJECT FULLY INSTRUMENTED FOR THE M092 EXPERIMENT.

LOWER BODY NEGATIVE PRESSURE PROTOCOL

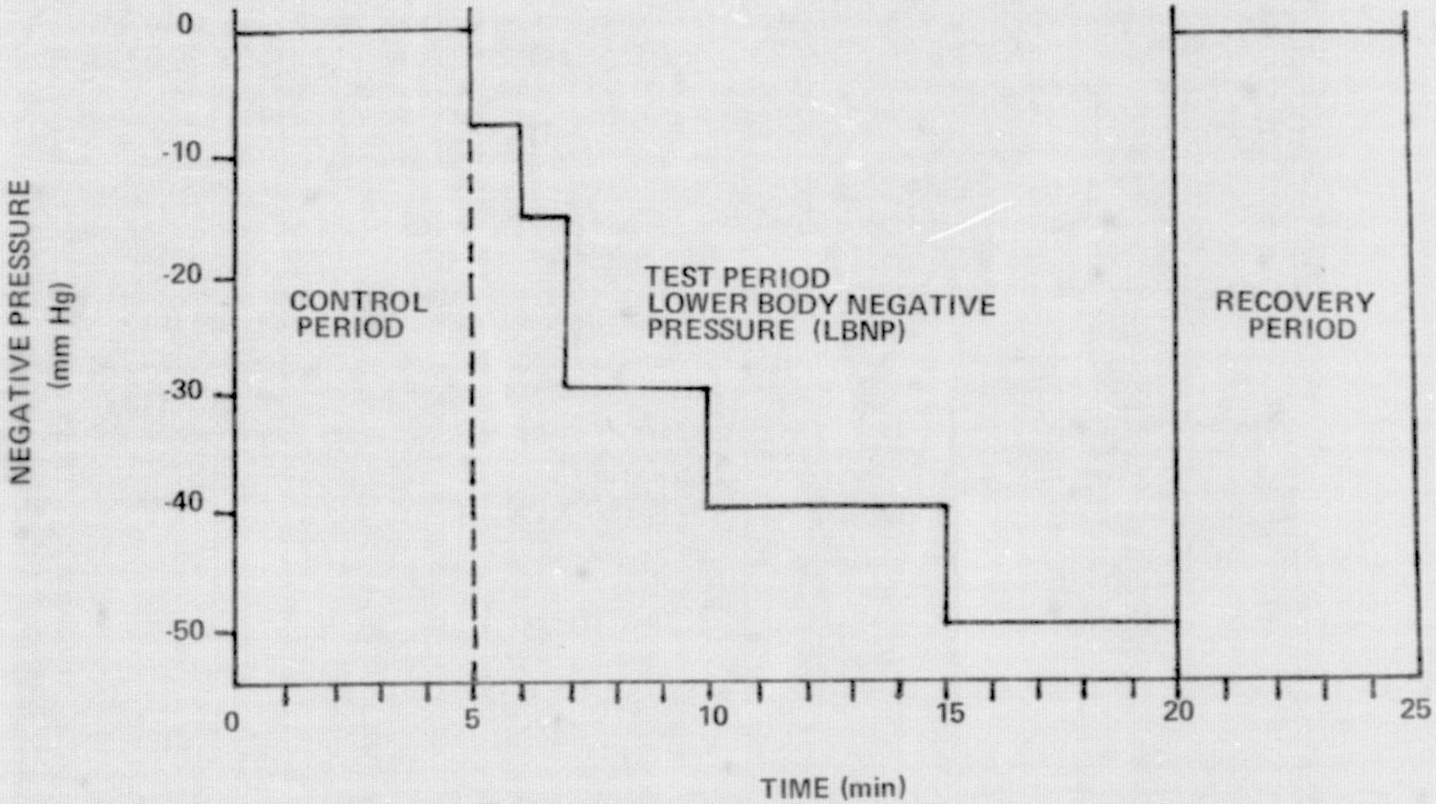

FIGURE 7. LOWER BODY NEGATIVE PRESSURE PROTOCOL USED FOR CARDIOVASCULAR EVALUATIONS.

The protocol required negative pressure to be applied in the following sequence: 1 minute of 8 and 16 mm Hg, 3 minutes of 30 mm Hg and 5 minutes of 40 and 50 mm Hg (Figure 8). The experiment was terminated if the subject experienced significant discomfort or if changes in nail color, facial expression, eye movement, or pupil size indicated a presyncopal episode.

LVMS Signal Processing

The detailed description of the signal processing was previously described in an earlier report (3) so only essential details will be described in this report. The overall simplified scheme of signal processing is illustrated in Figure 8. The outputs from the two leg bands in the configuration previously described are telemetered from the Skylab Workshop with a range of 0 to 5.0 volts. Each leg band's output data is then computer processed through its individual calibration curve. This process is, in effect, a data transform which adjusts the data to account for the characteristics of that particular leg band's calibration curve. The calibration report (2) from the Instrumentation Laboratory explains in detail the techniques used for obtaining calibration curve data. After the leg band data were individually adjusted, the compensation for temperature and humidity was accomplished as indicated by the summing junction of Figure 8. This type of processing was very effective at removing noise, electrical spikes or changes due to LBNPD termperature and humidity provided the artifact was of the same magnitude on both the left and right leg outputs. The calibration curve transforms, the output summation, data printout and initial computer plots of the M092 leg volume data were performed at NASA, Johnson Space Center, Houston, Texas.

The portion of the LVMS processing performed at the Instrumentation Laboratory, USAF Academy, is also indicated on Figure 8. The purpose of this processing was: (1) to remove any large artifacts such as electrical noise, spikes or offsets; (2) to establish the time associated with the

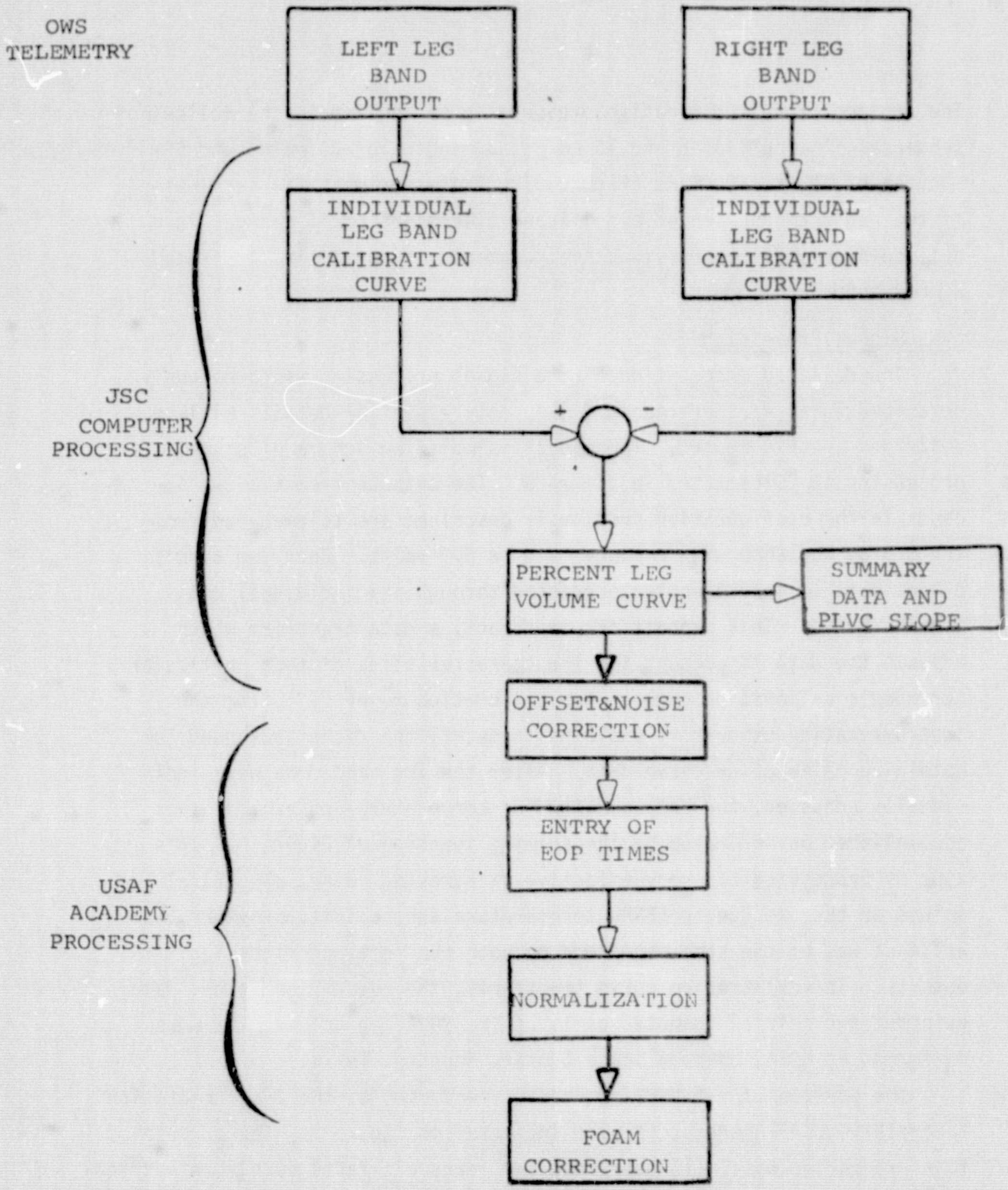

FIGURE 8. SCHEME FOR LEG VOLUME PROCESSING.

last data point in each of the seven periods of the M092 experiment; (3) to normalize the data to a baseline just prior to onset of negative pressure; (4) to perform the foam correction required for each leg band; and (5) to add pertinent identification or experiment information to each M092 experiment.

In order to perform the special signal processing flowcharted in Figure 9, it was necessary to develop techniques and programs capable of manipulating such a large data base. All computer programs utilized for signal processing are contained in the separate signal processing report (3).

The processing system consists of a Xerox Data Systems Sigma 5 digital computer and 7-track magnetic tape drive as well as the Interactive Graphics Terminal shown in Figure 10. This and other associated equipment used in the processing is shown in the block diagram of Figure 11.

The processing functions performed and charted in Figure 9 are typical operations for a real-time interactive graphics processor. In operation, the NASA data tape with additional identification information was loaded into the Sigma 5 computer and selected single or multiple parameters were displayed on a monitor in 3.3 minute segments of time. Corrective procedures (offset, entry of EOP times, normalization and foam correction) were performed and the data was saved for additional processing. The steps involved with the data processing performed by the Instrumentation Laboratory of the Air Force Academy were performed on all Skylab data. These steps as charted in Figure 9 consisted of a series of operations designed to produce a final consistent data configuration which would lend itself to automatic data processing by subject and mission. All of the raw data as received from JSC-Houston in the 7-track, 800 BPI, packed binary format was plotted as shown in Appendix B. After plotting the raw data, supplemental identification, anthropometric and environmental information was added to each run to expand the identification record from 12 to 42 elements. Tables 3 to 5

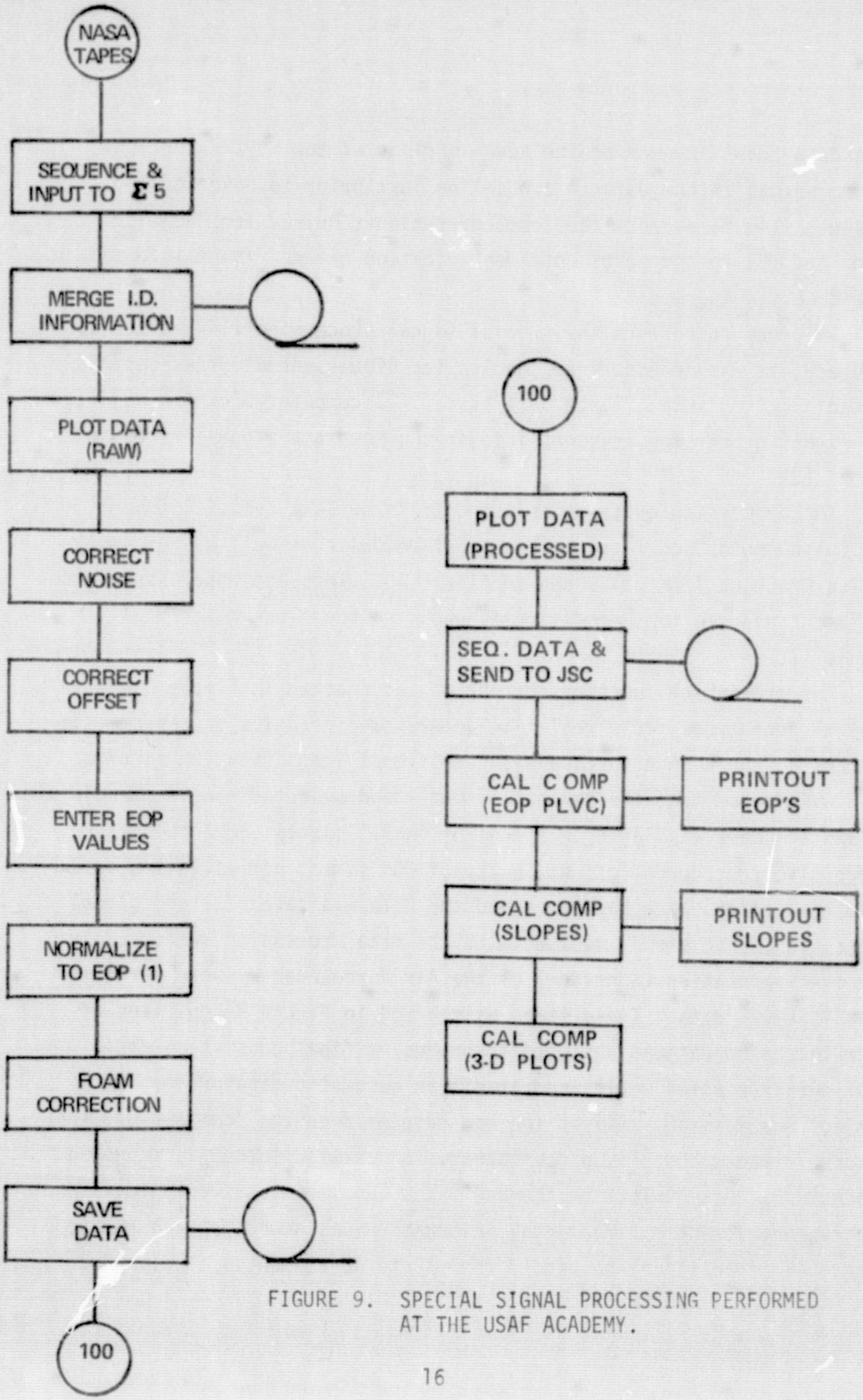

FIGURE 9. SPECIAL SIGNAL PROCESSING PERFORMED AT THE USAF ACADEMY.

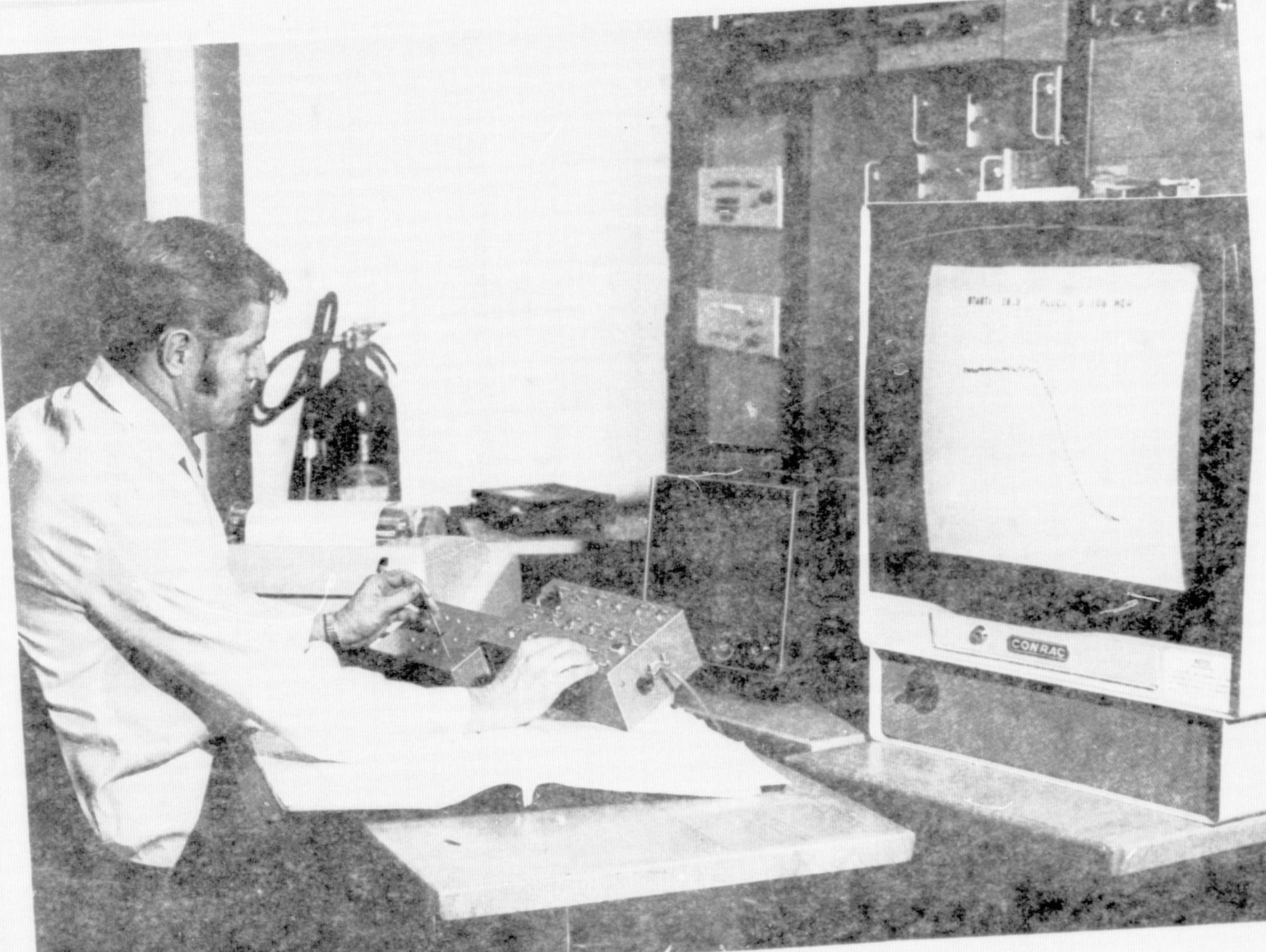

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FIGURE 10. INTERACTIVE GRAPHICS TERMINAL USED FOR SPECIAL PROCESSING OF SKYLAB LVMS DATA.

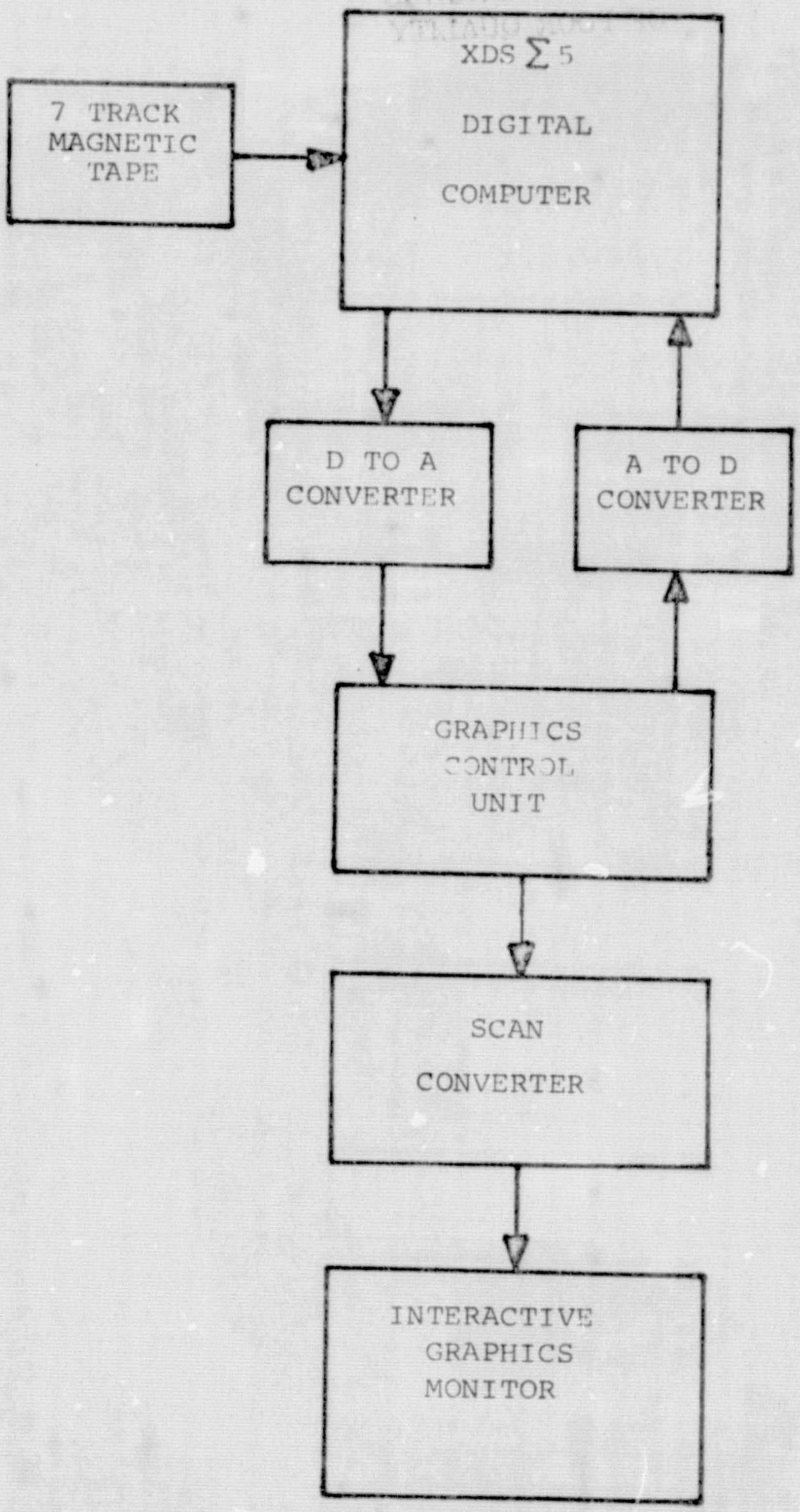

FIGURE 11. BLOCK DIAGRAM FOR SIGNAL PROCESSING.

contain the additional information and serve as summary data tables for each astronaut. The considerable amount of noise, wild points and offsets were removed from the data by the judicious use of the Wild Point Editor, Bias and Update functions of the Interactive Graphics Processor. Examples of raw and processed data plots are illustrated in Figures 12 to 19. In the course of the processing, more accurate end of period (EOP) times were obtained by sampling the time array must as the levels of negative pressure changed. These new times were added to the information elements of supplemental or summary data arrays. The EOP times obtained in this manner and used for all subsequent data processing are contained in Tables 6 to 8. Figure 20 contains the frequency of use data on plethysmographs used for the Skylab 2 Mission.

In order to simplify subsequent processing it was necessary to adjust the data (at least the PLVC data array) to a baseline or reference point. This was accomplished by normalizing the PLVC data array to the mean of the last 10 data samples just prior to the onset of the 8 mm Hg negative pressure level.

A foam correction factor was applied to the normalized percent leg volume change to account for the minor difference in leg volume resulting from the back pressure of the foam of the leg band upon the small vessels at the surface of the calf. The foam correction factor was determined from physiological tests comparing data taken with Whitney Guages and Capacitive Plethysmographs. The foam correction factor is a data transform using the best fit second order polynomial equation obtained experimentally for each band size. The equation used for the processing of all Skylab data was $Y = .001 + .90X - .002X^2$. The Y value was the output for the capacitive leg bands and the X represented the Whitney output. This foam correction factor enables the leg band calibration derived from the calibration cylinders to reflect the soft tissue-foam compression interaction on the skin of the calf.

The plots of the M092 leg volume data subjected to the above processing and representing the final data used for statistical comparison and analysis are contained in Appendix D.

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TABLE 3. SUMMARY DATA FOR SKYLAB 2 COMMANDER.

				LEFT LEG LVMS DATA				RIGHT LEG LVMS DATA								AMBIENT TEMPERATURE		LBNPD TEMPERATURE			
RUN NO.	JUL. DATA	EXPR. CODE	DATA CODE	BAND I.D.	CAL. REQ.	PRE.	POST	BAND I.D.	CAL. REQ.	PRE.	POST	L.L. CIRC	R.L. CIRC	BODY MASS	BODY TEMP	START	END	START	P1	P4	P5
1	357	1	1	BY	3.70	3.68	3.75	BT	3.10	3.21	3.20	36.20	36.80	70.3	****	23.3	23.6	23.9	24.1	24.5	24.9
2	25	1	1	BY	3.70	3.73	3.76	BL	3.90	3.82	3.90	36.20	36.20	68.5	37.0	21.3	21.5	22.0	22.2	22.7	22.9
3	61	1	34	BL	3.90	3.84	3.98	BT	3.10	3.09	3.18	35.60	35.90	64.4	36.6	21.2	21.3	22.0	22.2	22.6	22.8
4	78	1	37	BP	3.10	3.14	3.15	BL	3.90	3.94	3.95	35.60	35.90	63.5	36.9	21.2	21.4	22.0	22.2	22.8	22.8
5	106	1	37	AP	3.00	2.00	2.59	BA	3.10	2.10	2.00	34.60	34.30	64.0	36.2	25.0	24.0	24.1	24.1	25.0	25.6
6	131	1	3	AV	3.50	3.42	3.60	BP	3.10	3.02	3.17	34.60	35.60	62.3	****	20.7	20.8	21.2	21.4	22.0	22.2
7	149	2	38	CI	3.20	3.17	3.12	CH	4.50	4.56	4.56	33.70	34.00	61.4	36.7	31.4	31.4	33.2	33.2	33.2	33.3
8	153	2	8	CH	3.20	3.12	3.07	CI	4.50	4.49	4.51	33.30	33.30	61.7	36.8	27.4	27.3	28.6	28.7	28.9	29.2
9	156	2	1	CI	4.50	4.35	4.28	CH	3.20	3.21	3.21	33.00	33.30	61.6	36.7	25.8	25.8	27.7	27.4	27.6	27.7
10	160	2	1	CH	3.20	3.17	3.10	CI	4.50	****	****	32.90	33.00	61.0	36.6	25.2	25.3	26.8	26.8	26.9	27.2
11	163	2	1	CH	3.20	3.07	3.07	CI	4.50	4.47	4.44	33.00	33.00	61.2	****	26.8	26.4	28.2	28.3	28.4	28.5
12	166	2	1	CH	3.20	3.07	3.17	CI	4.50	4.49	4.44	32.70	32.70	61.3	36.8	26.8	27.1	28.1	28.2	28.4	28.6
13	169	2	23	CJ	3.50	****	3.36	AX	3.70	****	3.71	32.70	33.00	****	36.4	26.6	26.5	27.9	28.0	28.2	28.3
14	173	3	3	AA	3.50	3.56	3.38	AU	3.20	2.90	2.91	32.80	33.00	60.8	36.1	26.5	26.2	25.3	25.8	****	25.9
15	174	3	8	AA	3.50	3.68	3.57	AU	3.20	3.07	3.03	33.40	33.50	60.6	37.0	22.8	23.3	25.0	24.7	24.8	24.4
16	175	3	1	AA	3.50	3.00	3.57	AU	3.20	2.93	2.96	33.40	33.60	60.7	****	26.2	23.3	23.3	****	****	24.4
17	177	3	1	AP	3.00	****	****	AU	3.20	****	****	33.00	33.40	61.2	36.4	24.4	23.1	24.4	****	****	23.6
18	181	3	3	AP	3.00	2.81	3.04	CY	3.60	3.65	3.67	33.00	34.00	61.7	36.7	22.4	22.5	24.1	23.5	23.7	23.9
19	187	3	8	CY	3.60	3.44	3.67	AP	3.00	2.90	3.08	33.80	34.30	61.0	37.0	23.1	23.3	25.3	25.2	25.2	25.3
20	193	3	1	AP	3.00	2.79	2.92	CY	3.60	3.61	3.72	33.70	33.80	61.2	36.4	21.9	23.3	23.9	24.3	24.5	25.0
21	236	3	1	AH	3.50	3.33	3.31	BQ	3.30	3.16	3.23	35.40	35.90	****	36.0	21.4	22.1	22.7	22.7	23.1	23.3

* Indicates data was not available.

EXPR CODE 1 = Preflight 2 = In-flight 3 = Postflight

Data Code is a condition code for signal processing (See Appendix C)

TABLE 4. SUMMARY DATA FOR SKYLAB 2 SCIENTIST PILOT.

RUN NO.	JUL. DATA	EXPR. CODE	DATA CODE	LEFT LEG LVMS DATA BAND I.D.	CAL. REQ.	PRE.	POST	RIGHT LEG LVMS DATA BAND I.D.	CAL. REQ.	PRE.	POST	L.L. CIRC	R.L. CIRC	BODY MASS	BODY TEMP	AMBIENT TEMPERATURE START	END	LBNPD TEMPERATURE START	P1	P4	P5
1	357	1	5	CB	3.40	3.51	3.57	AG	3.70	3.77	3.74	38.10	38.10	79.4	36.9	23.5	23.8	24.4	24.6	24.9	25.2
2	26	1	8	AG	3.70	3.58	3.76	CB	3.40	3.21	3.43	38.70	38.70	79.4	36.9	22.3	22.3	23.1	23.2	23.9	23.9
3	57	1	5	BF	3.20	3.30	3.15	AG	3.70	3.80	3.76	38.70	38.10	79.4	37.2	22.3	22.4	23.1	23.3	23.8	23.9
4	78	1	8	BF	3.20	3.28	3.25	AG	3.70	3.70	3.74	39.10	38.40	79.4	36.8	20.9	20.9	21.9	22.2	22.6	22.8
5	106	1	1	BA	3.10	2.06	2.10	BE	3.00	3.07	3.13	38.10	37.80	78.3	36.7	22.0	25.5	24.2	24.1	25.1	25.6
6	131	1	7	BY	3.70	3.63	3.79	AG	3.70	3.63	3.74	37.50	37.20	77.6	36.7	20.9	20.9	21.7	21.9	22.4	22.7
7	149	2	5	BV	3.60	3.78	3.73	BK	3.60	3.71	3.81	36.40	36.20	75.6	36.8	30.4	30.7	32.1	32.2	32.2	32.6
8	154	2	1	AD	3.40	3.38	3.47	BJ	3.20	3.24	3.24	36.20	35.20	75.9	36.6	26.8	26.8	28.0	28.0	28.1	28.2
9	157	2	48	AD	3.40	3.31	3.38	BJ	3.20	3.14	3.12	36.20	35.90	74.7	36.9	25.8	26.0	27.3	27.5	27.7	27.9
10	161	2	6	AD	3.40	3.28	3.14	BJ	3.20	3.12	3.19	35.90	35.20	76.0	****	25.8	25.8	27.6	27.6	27.7	27.8
11	164	2	67	BJ	3.20	3.12	****	AD	3.40	3.31	3.31	35.20	35.90	75.4	****	27.1	27.2	28.9	28.9	29.1	29.2
12	167	2	6	BJ	3.20	3.03	3.08	AD	3.40	3.29	3.31	35.90	35.90	75.6	****	27.3	27.2	28.9	28.9	29.0	29.2
13	169	2	46	BJ	3.20	3.19	3.12	AD	3.40	3.33	3.33	35.90	35.20	****	****	27.1	27.2	28.4	28.5	28.7	28.9
14	173	3	48	BC	3.60	****	3.95	BB	3.30	3.28	3.29	36.00	35.30	74.5	****	22.8	23.3	24.3	24.3	24.3	24.4
15	174	3	6	BC	3.60	3.11	3.55	BB	3.30	3.23	3.41	36.20	35.70	73.8	36.9	22.3	23.2	23.6	23.8	24.1	24.2
16	175	3	6	BB	3.30	3.14	3.48	BA	3.10	3.11	3.17	36.80	35.80	75.1	37.3	21.9	21.3	18.3	****	****	18.3
17	177	3	1	BB	3.30	****	****	BA	3.10	****	****	36.60	36.20	74.6	36.8	23.9	22.8	24.4	****	****	24.2
18	181	3	1	BB	3.30	3.14	3.29	BA	3.10	3.04	3.20	37.40	37.20	75.1	36.7	23.1	23.0	24.7	24.6	24.7	24.8
19	187	3	8	BA	3.10	3.11	3.10	BB	3.30	3.40	3.48	36.90	36.50	74.8	36.8	23.1	22.8	24.2	24.2	24.1	24.4
20	197	3	8	BB	3.30	3.21	3.34	CC	3.90	3.00	3.15	37.30	37.70	77.1	37.1	22.5	21.9	23.3	23.4	23.4	23.6
21	236	3	1	AF	3.70	3.65	3.58	BG	3.30	3.26	3.29	37.80	37.50	77.1	35.7	20.5	20.8	21.9	21.9	22.4	22.6

* Indicates data was not available.

EXPR CODE 1 = Preflight 2 = In-flight 3 = Postflight

Data Code is a condition code for signal processing (See Appendix C)

TABLE 5. SUMMARY DATA FOR SKYLAB 2 PILOT.

RUN NO.	JUL. DATA	EXPR. CODE	DATA CODE	LEFT LEG LVMS DATA BAND I.D.	CAL. REQ.	PRE.	POST	RIGHT LEG LVMS DATA BAND I.D.	CAL. REQ.	PRE.	POST	L.L. CIRC	R.L. CIRC	BODY MASS	BODY TEMP	AMBIENT TEMPERATURE START	END	START	LBNPD TEMPERATURE P1	P4	P5
1	357	1	1	MT	3.10	3.20	3.32	BY	3.70	3.80	3.85	38.10	37.50	83.9	37.1	23.0	23.0	23.7	23.8	24.3	24.4
2	30	1	78	AG	3.60	3.58	3.65	AT	3.10	3.14	3.03	37.80	36.80	83.9	36.0	23.0	23.2	23.2	23.7	24.2	24.4
3	57	1	1	BL	3.90	3.82	3.87	BY	3.70	3.68	3.76	37.50	36.80	83.5	37.1	21.9	22.3	22.8	22.9	23.3	23.7
4	78	1	1	MY	3.70	3.70	3.63	AT	3.14	3.14	3.19	37.30	37.00	82.6	36.9	21.1	21.2	21.7	22.2	22.8	22.9
5	106	1	1	MA	3.10	2.08	2.23	AP	3.00	2.13	2.21	37.50	37.20	83.1	36.4	26.5	26.5	25.0	25.1	25.1	25.3
6	131	1	1	BY	3.70	3.65	3.62	AT	3.10	3.00	3.10	37.80	37.20	79.6	37.1	21.2	21.2	22.0	22.2	22.7	22.9
7	148	2	1	MJ	3.40	3.10	****	AD	3.20	3.36	****	36.20	35.60	****	37.1	34.4	34.7	35.7	35.8	36.0	36.1
8	151	2	8	BJ	3.20	3.12	3.12	AD	3.40	3.36	3.33	35.90	35.20	78.9	37.0	30.4	30.8	29.3	30.5	30.8	30.8
9	155	2	7	CH	3.20	3.24	3.03	AI	4.50	4.44	4.51	34.30	33.70	78.8	37.2	26.4	26.0	25.7	27.5	27.8	27.9
10	159	2	7	CJ	3.50	3.43	3.43	AK	3.70	3.61	3.60	34.30	33.70	78.1	36.6	24.2	24.3	25.9	25.8	25.9	26.2
12	165	2	78	AX	3.70	****	3.58	AJ	3.50	****	3.38	33.70	33.30	77.9	****	27.7	27.7	29.6	29.6	29.6	29.6
13	168	2	47	CJ	3.50	****	3.54	AX	3.70	****	3.59	34.30	33.30	77.7	37.4	26.8	26.8	28.5	28.6	28.6	28.8
14	171	2	67	CJ	3.50	****	3.45	AX	3.70	****	3.64	34.00	33.30	77.4	36.9	27.7	28.0	29.2	29.3	29.4	29.7
15	173	3	1	AU	3.20	2.81	2.90	AP	3.00	3.00	3.03	34.40	34.30	76.5	35.9	23.6	23.7	24.5	24.4	24.4	24.6
16	174	3	7	AU	3.20	****	****	AP	3.00	****	****	35.40	35.30	76.4	36.3	23.4	24.1	24.8	24.5	24.1	24.9
17	175	3	38	AP	3.00	2.69	3.01	AU	3.20	2.83	2.92	35.00	34.40	78.1	36.6	22.3	21.7	23.6	23.7	23.9	24.2
18	177	3	38	BR	3.30	3.07	3.29	AA	3.10	3.02	3.15	35.70	35.20	77.3	36.7	22.2	22.5	24.5	24.1	23.9	23.9
19	181	3	38	MA	3.10	2.95	3.15	AB	3.30	3.33	3.39	36.20	35.40	77.5	36.7	23.1	23.3	25.6	24.9	24.9	25.6
20	186	3	38	MA	3.10	3.14	3.18	AB	3.30	3.28	****	35.50	35.50	77.2	37.0	22.8	23.3	23.3	23.8	23.9	24.2
21	194	3	1	MA	3.10	****	2.94	AB	3.30	****	3.39	36.70	35.60	79.6	36.9	24.4	24.4	26.1	26.1	26.0	25.8
22	236	3	8	BY	3.70	3.65	3.72	AT	3.10	3.14	3.13	37.80	36.80	81.3	36.9	21.1	21.3	22.1	22.2	22.7	22.9

* Indicates data was not available.

EXPR CODE 1 = Preflight 2 = In-flight 3 = Postflight

Data Code is a condition code for signal processing (See Appendix C)

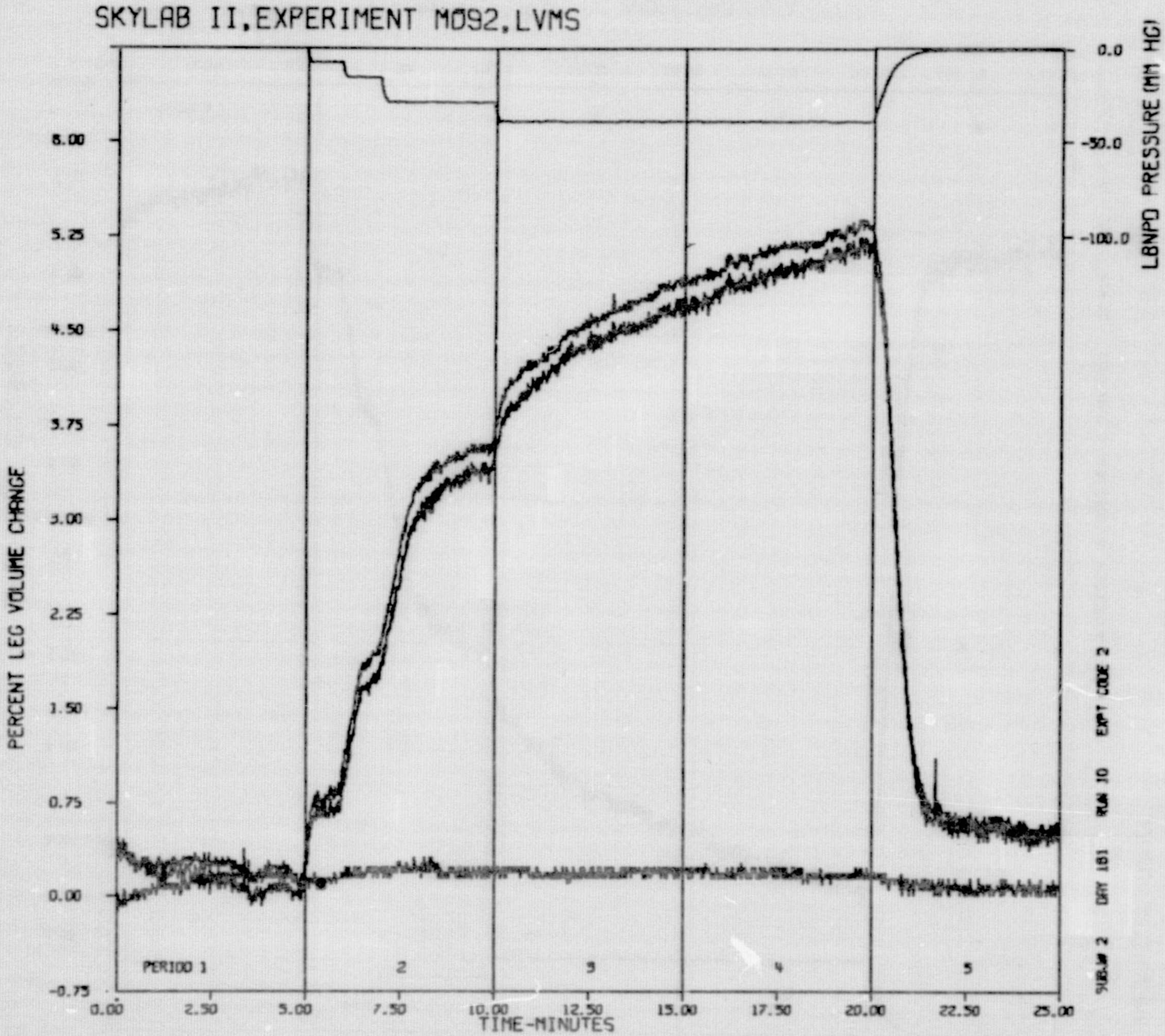

FIGURE 12. PLOT OF UNPROCESSED DATA.

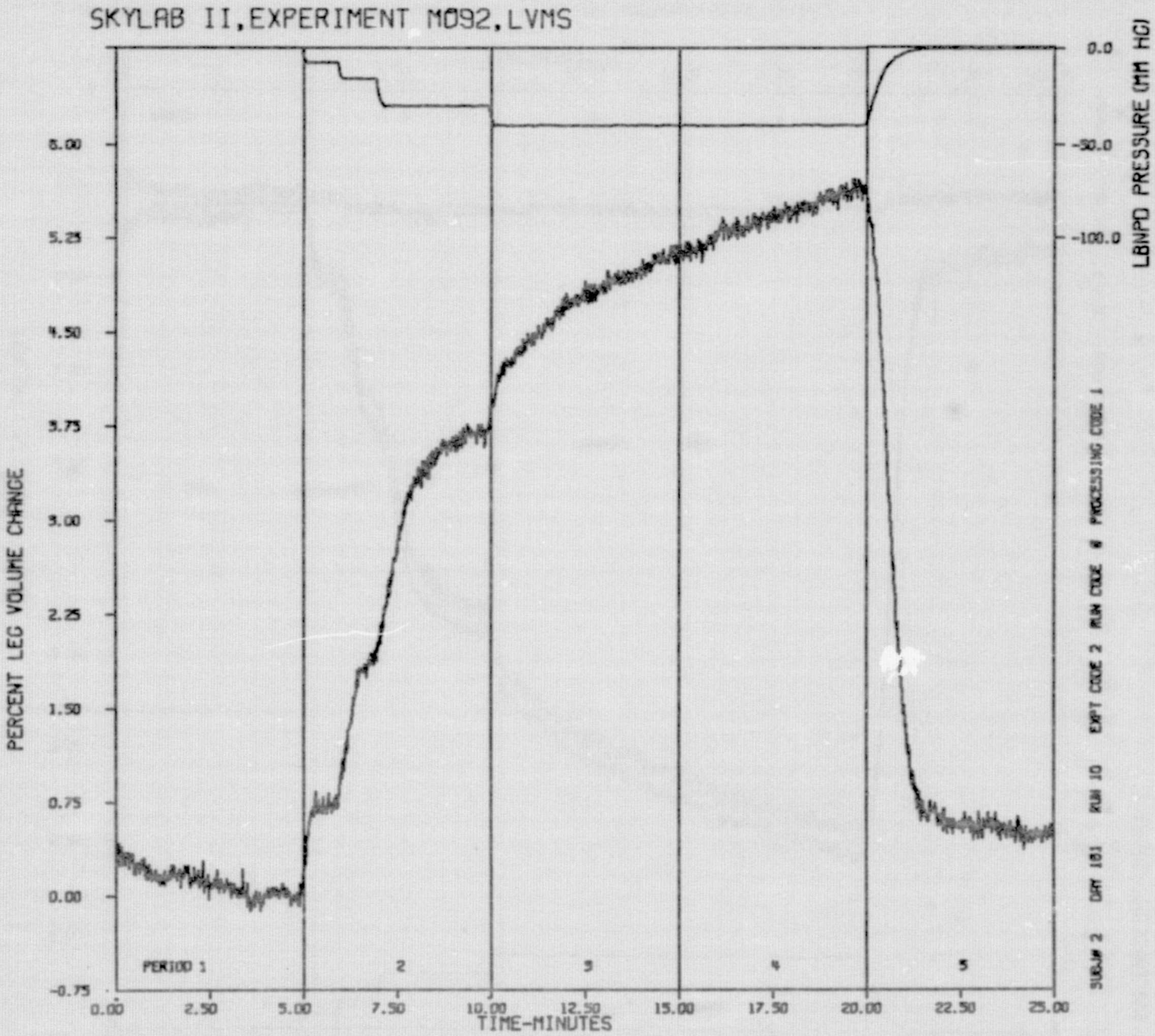

FIGURE 13. PLOT OF PROCESSED DATA.

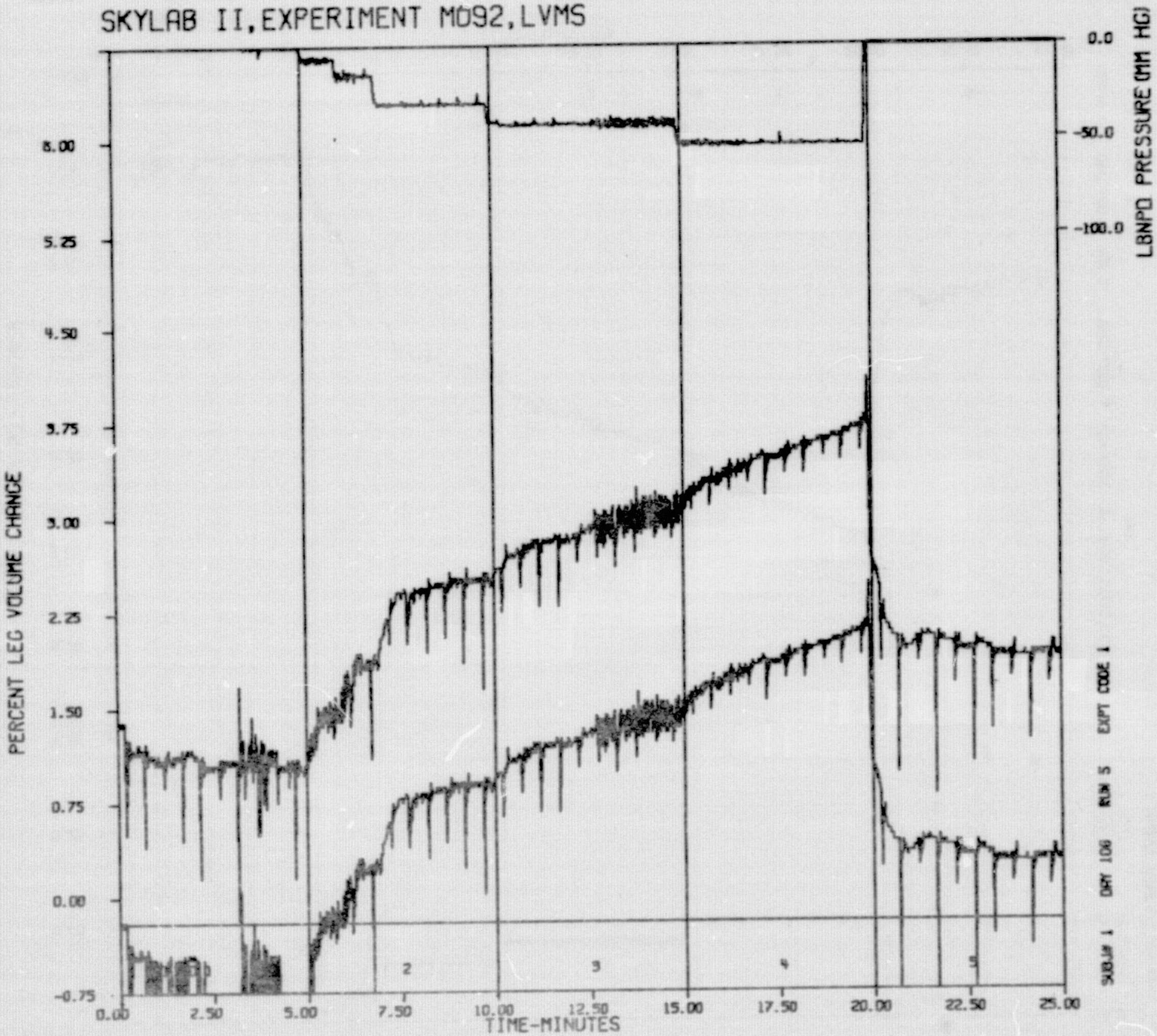

FIGURE 14. PLOT OF DATA WITH NOISE AND ELECTRICAL SPIKES.

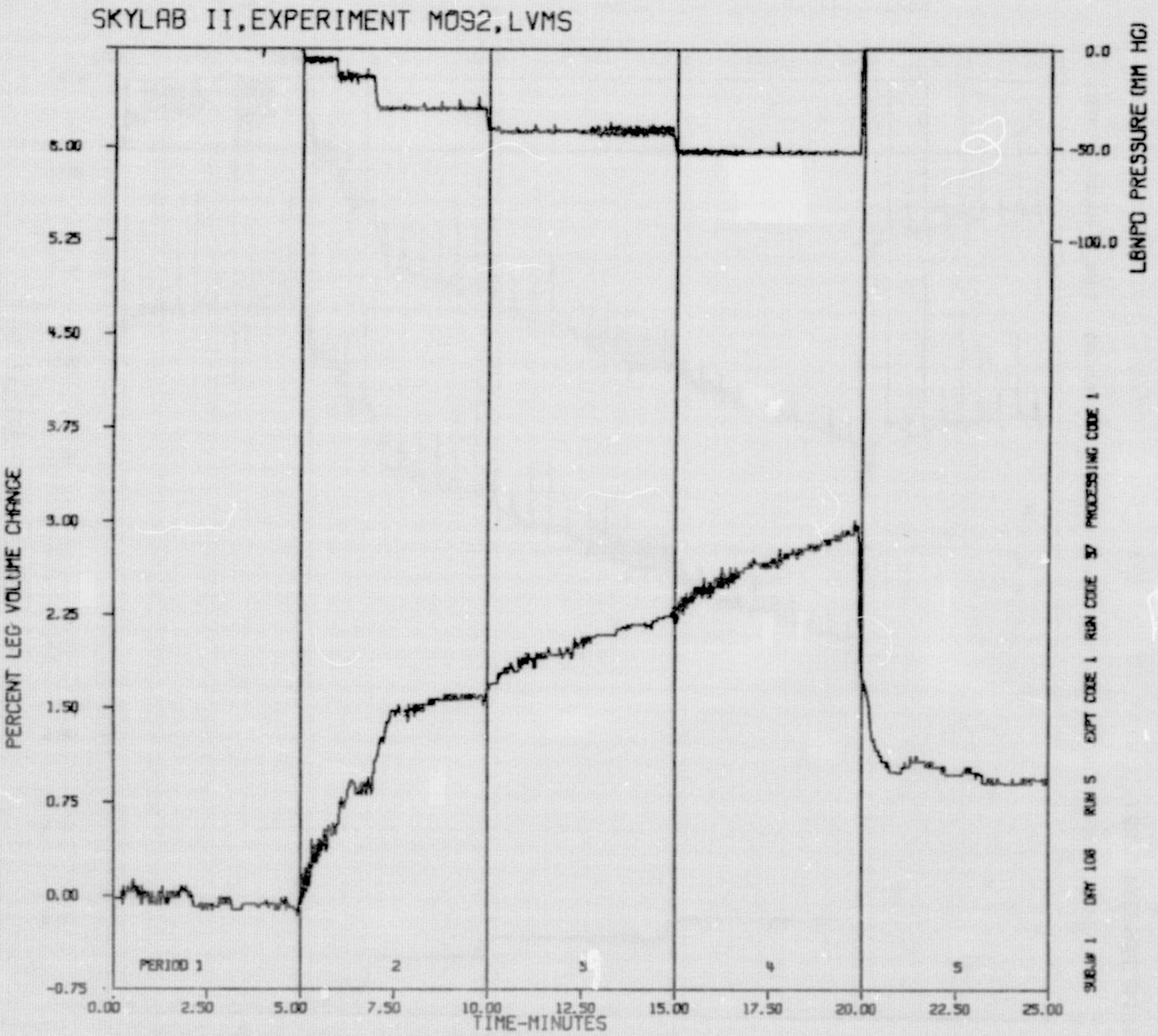

FIGURE 15. FINAL PROCESSED DATA.

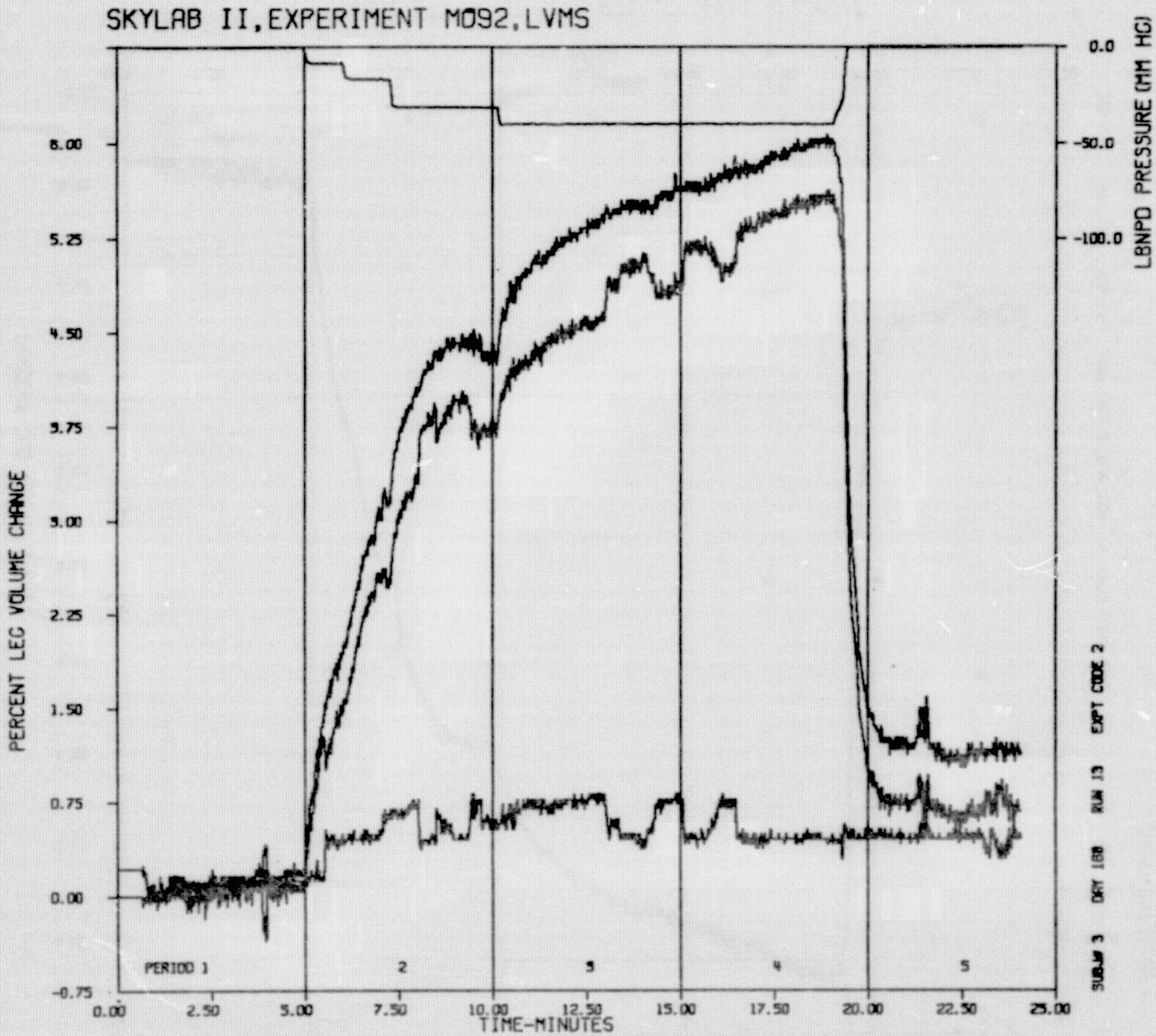

FIGURE 16. PLOT OF DATA WITH OFFSETS ON RIGHT LEG OUTPUT.

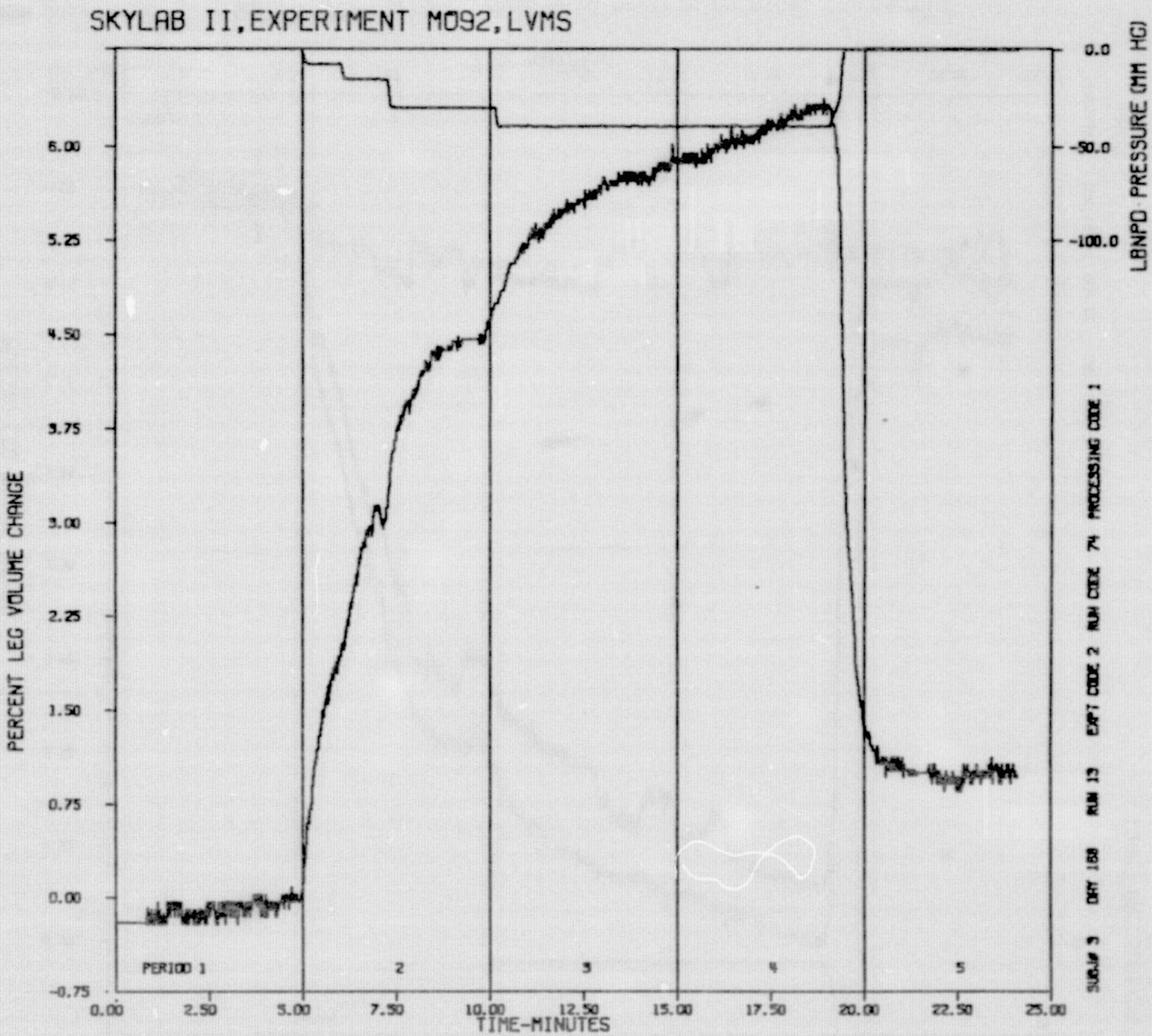

FIGURE 17. PLOT OF CORRECTED LEFT LEG DATA.

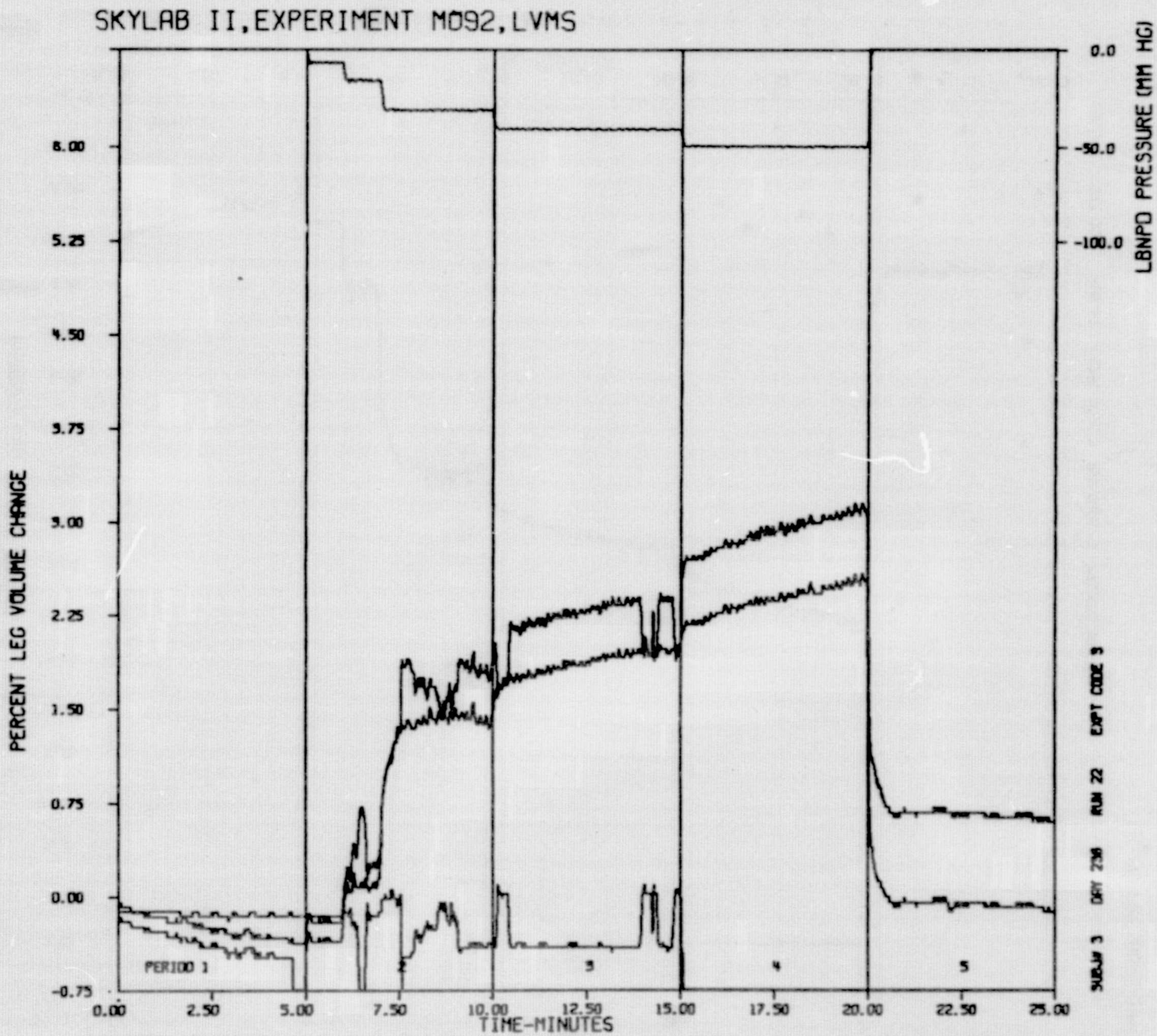

FIGURE 18. PLOT OF DATA WITH NOISE ON BOTH LEFT AND RIGHT LEG OUTPUTS.

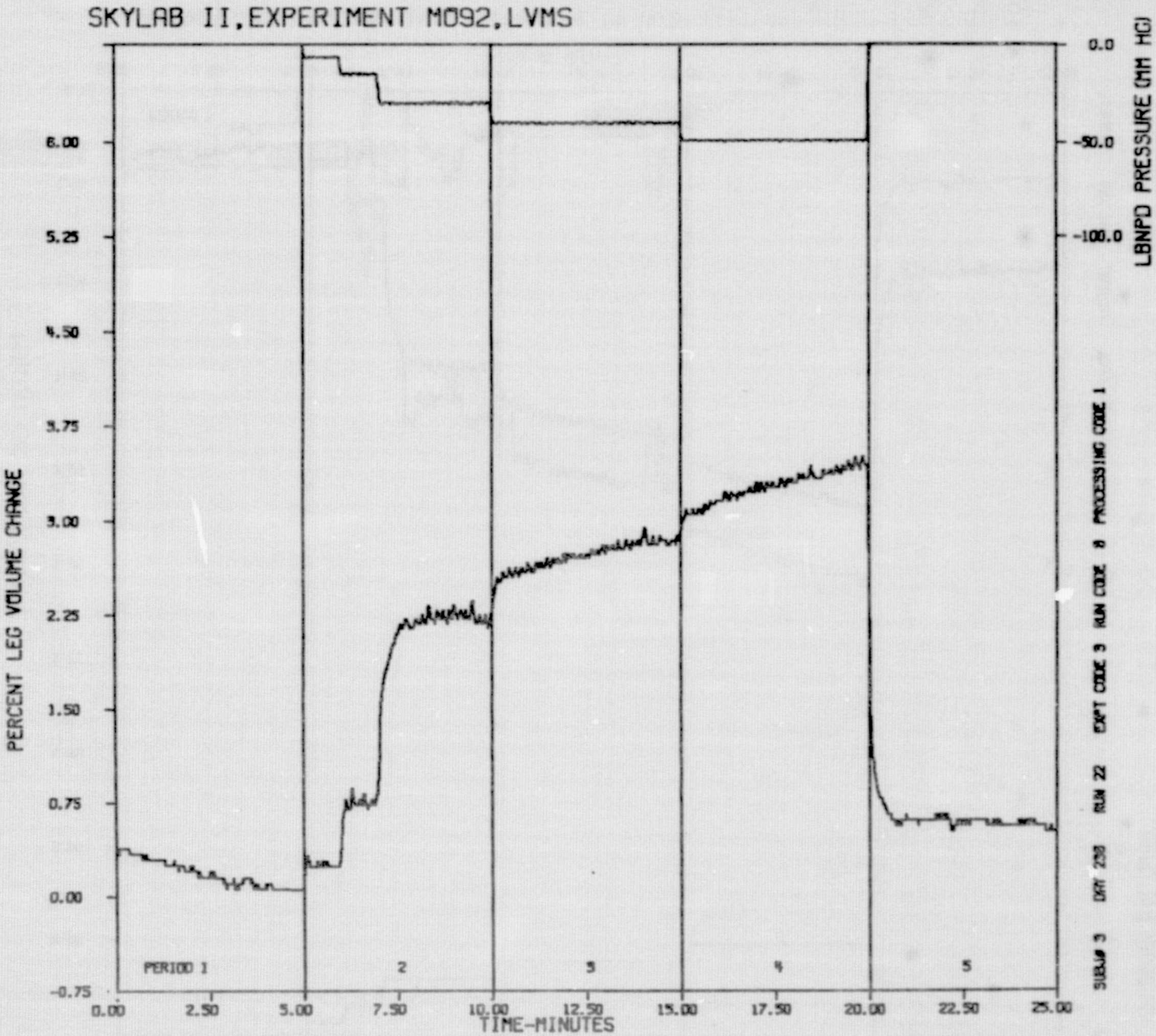

FIGURE 19. FINAL PROCESSED PLVC DATA.

TABLE 6. ELAPSED TIME TO END OF PERIOD (EOP) FOR SKYLAB 2 COMMANDER.

RUN NO.	JUL. DATE	ELAPSED TIME(SECONDS) TO END OF PERIOD CONTROL	-8	-16	-30	-40	-50	RECOVERY
1	357	278.39893	341.59888	418.39893	602.39893	899.99780	1201.59692	1499.19580
2	25	299.99878	357.59888	416.79785	597.59790	897.59692	1195.99585	1499.19482
3	61	139.19998	192.00000	254.39999	431.99878	734.39795	1032.79688	1333.59595
4	78	297.59985	354.39893	415.19897	595.19897	887.19800	1194.39697	1495.19580
5	106	298.39990	354.39990	414.39990	592.79980	892.00000	1192.79980	1499.19995
6	131	297.59888	356.79893	418.39893	607.19800	896.79785	1195.19678	1499.19580
7	140	298.39990	363.14990	403.14893	582.34985	882.32495	1182.32495	1481.52490
8	153	298.39990	355.09878	413.59985	598.39990	894.39990	1195.99878	1499.04883
9	156	293.59985	359.19985	420.00000	595.99878	898.39990	1199.19995	1499.19995
10	160	298.39893	358.39893	418.39893	599.19995	898.39993	1199.19995	1499.19995
11	163	298.39990	360.80078	414.39990	596.80078	896.72583	1196.72583	1496.67578
12	166	299.40088	353.59985	414.39990	603.20093	890.40088	1194.39990	1494.39990
13	169	297.60093	356.77588	417.57495	587.94995	895.95093	1195.95093	1497.50000
14	173	299.19995	360.79980	420.00000	600.00000	900.79980	1200.79980	1499.19995
15	174	299.19995	360.00000	420.00000	600.00000	900.00000	1200.00000	1499.19995
16	175	299.19995	360.00000	419.19995	599.19995	899.19995	1199.19995	1499.19995
17	177	299.19995	359.19995	419.19995	599.19995	900.00000	1199.19995	1499.19995
18	181	299.19995	360.00000	420.00000	600.00000	900.00000	1200.00000	1499.19995
19	187	299.19995	359.19995	420.00000	599.19995	898.39990	1199.19995	1499.19995
20	193	299.19995	360.00000	420.00000	600.00000	900.00000	1200.00000	1497.59985
21	236	299.19897	357.59888	417.59888	597.59790	897.59692	1196.79590	1496.79492

TABLE 7. ELAPSED TIME TO END OF PERIOD (EOP) FOR SKYLAB 2 SCIENTIST PILOT.

RUN NO.	JUL. DATE	ELAPSED TIME(SECONDS) TO END OF PERIOD CONTROL	-8	-16	-30	-40	-50	RECOVERY
1	357	274.79808	285.50888	347.90878	523.19897	824.70785	1282.39697	1499.19580
2	26	299.19897	357.50888	418.39873	596.79785	897.59692	1198.39600	1430.79490
3	57	298.39893	351.90878	421.59888	587.99780	886.39697	1214.39600	1487.19480
4	78	298.39990	352.79889	416.79883	592.79883	889.59790	1197.59692	1499.19580
5	106	297.59985	357.50985	416.79980	598.39990	896.79080	1196.79980	1499.19995
6	131	298.39990	355.10985	414.39893	596.79883	895.99780	1195.99683	1495.19580
7	149	299.19995	364.70883	420.79980	605.59888	897.59888	1197.59888	1497.59888
8	154	298.37378	357.57495	428.77490	599.17383	897.52390	1196.72388	1497.52390
9	157	298.39893	360.79980	420.00000	600.79980	894.39990	1112.00000	1412.79883
10	161	297.59888	355.10995	415.99878	595.19995	896.79883	1197.59888	1499.19995
11	164	296.00000	360.00000	420.00000	603.20093	904.00098	1211.20093	1499.20093
12	167	297.57495	359.17480	421.57495	599.17480	900.77490	1199.09888	1499.09888
13	169	297.59985	356.70980	417.59985	596.00000	898.39990	1064.00000	1364.79980
14	173	296.00000	356.70980	416.79980	597.59985	804.79980	0.50000	1103.19995
15	174	299.19995	363.10995	419.19995	599.19995	900.00000	1200.00000	1499.19995
16	175	299.19995	360.00000	420.00000	600.00000	900.79080	1201.59985	1499.19995
17	178	299.19995	359.10985	419.19995	599.19995	899.19995	1199.19995	1499.19995
18	181	300.00000	360.00000	420.00000	600.00000	900.00000	1200.00000	1499.19995
19	187	300.00000	360.00000	420.00000	600.00000	900.00000	1201.59985	1499.19995
20	197	298.39990	358.39990	418.19990	598.39990	897.59085	1197.59985	1498.39990
21	236	299.19897	358.39795	417.59790	598.39795	898.39600	1198.39478	1498.39380

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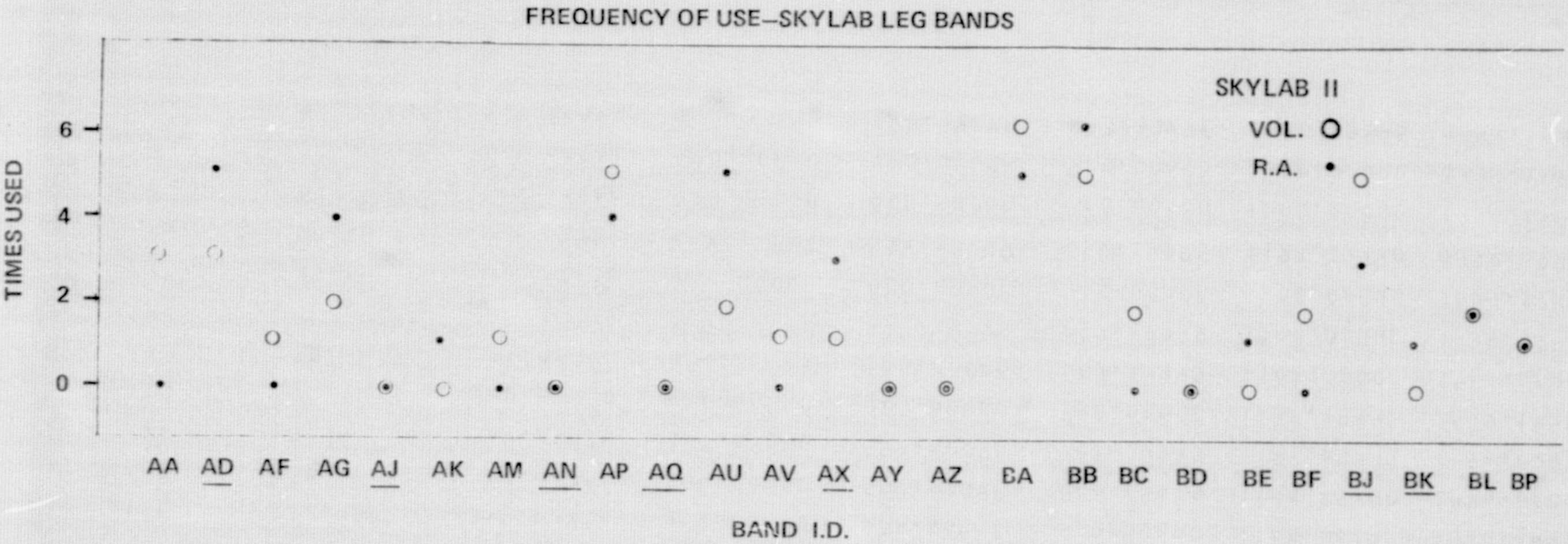
TABLE 8. ELAPSED TIME TO END OF PERIOD (EOP) FOR SKYLAB 2 PILOT.

RUN NO.	JUL. DATE	ELAPSED TIME(SECONDS) TO END OF PERIOD						
		CONTROL	-8	-16	-30	-40	-50	RECOVERY
1	357	298.39990	357.59985	418.39990	599.19995	895.19897	1208.79785	1498.39697
2	36	297.59888	360.79883	419.19897	600.79785	896.79688	1195.99585	1496.79492
3	57	295.19995	355.19897	414.39893	595.19897	893.59790	1193.59692	1491.19580
4	78	299.19897	350.39893	453.59888	591.19800	895.19678	1192.79590	1491.99487
5	106	296.00000	356.00000	416.00000	596.00000	896.00000	1196.00000	1496.79980
6	131	295.99878	355.19897	415.19897	595.19800	895.19678	1195.19580	1499.19482
7	148	297.59888	353.59985	413.59985	592.79980	896.79883	1196.00000	1496.67383
8	151	296.00098	352.80078	420.80078	596.00098	896.00098	1197.60083	1498.39990
9	155	297.59888	339.90878	309.19897	624.79980	880.79883	1183.09888	1484.69995
10	159	296.79883	384.00000	414.39990	603.99878	892.79883	1191.19995	1493.59888
12	165	242.44897	312.04980	360.04980	634.44897	0.50000	1140.04980	1440.84985
13	168	298.40088	360.00000	436.00000	608.00098	844.79980	1144.79980	1444.00000
14	171	290.52588	349.60995	428.89800	594.50098	897.69995	1197.69995	1496.82495
15	173	299.19995	360.00000	420.00000	600.00000	900.00000	1199.19995	1499.19995
16	174	282.39990	324.00000	383.19995	564.00000	863.19995	1164.00000	1464.00000
17	175	299.19995	359.19995	419.19995	599.19995	899.19995	1200.00000	1499.19995
18	178	299.19995	360.79980	420.00000	600.00000	900.00000	1200.00000	1499.19995
19	181	299.19995	359.19995	419.19995	599.19995	899.19995	1198.39990	1499.19995
20	186	299.19995	360.00000	420.00000	600.00000	900.00000	1200.00000	1499.19995
21	194	299.19995	360.00000	420.00000	600.00000	900.00000	1200.00000	1499.19995
22	236	299.19897	358.39893	418.39795	598.39795	898.39697	1197.59595	1497.59497



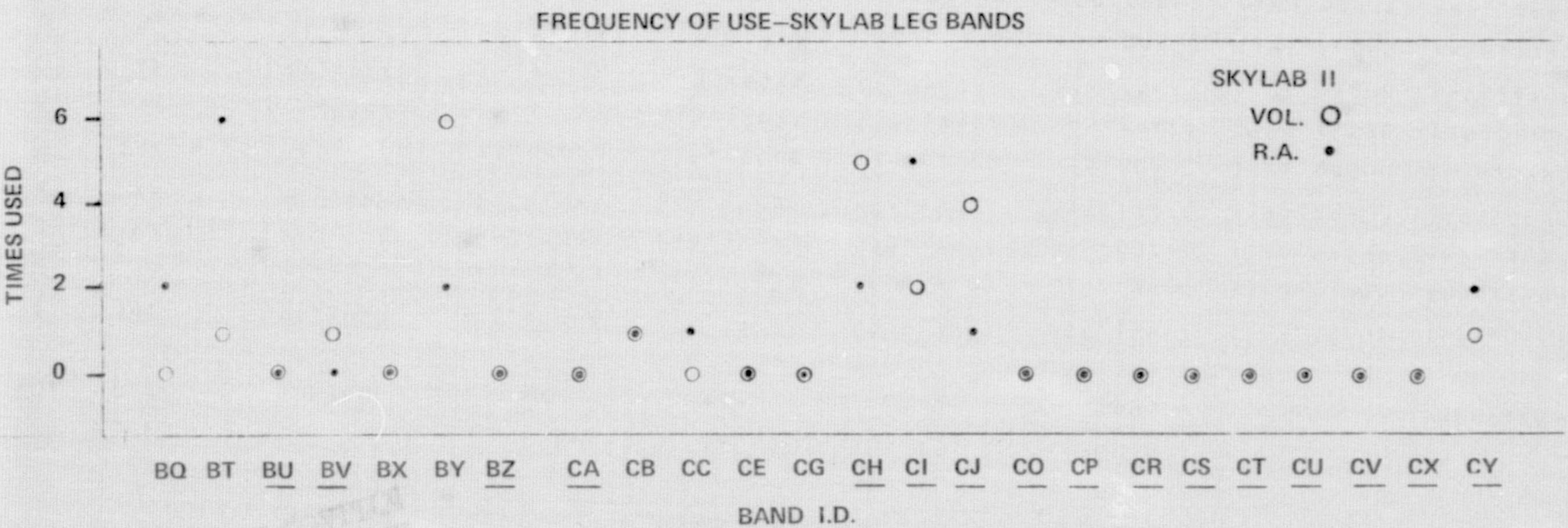


FIGURE 20. FREQUENCY OF USE FOR PLETHYSMOGRAPH FOR SKYLAB 2 MISSION. Vol. (O) indicates use on left leg; R.A. (•) indicates use on right leg reference adapter. Underlined band ID indicates band in Skylab workshop.

RESULTS

Calf Volume

It was anticipated that some change in leg volume due to LBNP would be observed upon exposure to zero-gravity. The magnitude of the percentage change at the calf was impressive. The data contained in Tables 9 through 11 show the end of period (EOP) percentage change in calf volume at each level of negative pressure for each experiment. These data are plotted in Figures 21 to 23. The EOP percentage change in calf volume is computed by averaging the last ten data samples in each test (i.e., -8, -16, etc.). All data was previously normalized so that period 1 or control period EOP values were zero. The EOP PLVC data demonstrate the dramatic increase in leg volume change at the time of the first LBNP test in weightlessness. While the volume response was tremendously increased (particularly at the lower levels of negative pressure) in the commander and pilot, it remained relatively the same for the scientist pilot increasing only at the smaller levels of negative pressure (-8 and -16). However, by the next test day the leg volume changes for the scientist pilot increased significantly higher to at least the level of the other astronauts. The time course of the in-flight leg volume response is such that the astronauts for this mission appear to stabilize around a higher leg volume response demonstrating fairly large variations and not establishing a significant long-term trend. The complete LBNP protocol was utilized only on the commander with substitution of -40 mm Hg for the -50 mm Hg portion of the LBNP protocol for the scientist pilot and pilot who appeared unable to tolerate the -50 mm Hg level of pressure in-flight. Linear regression of the in-flight EOP PLVC data indicates a pattern of slightly decreasing EOP volumes for the commander with slightly increasing volumes for the scientist pilot and pilot. In all three astronauts the trend is not significant for the 28 days of weightlessness.

TABLE 9. END OF PERIOD (EOP) VALUES OF PERCENTAGE CHANGE IN CALF VOLUME BY LEVEL OF NEGATIVE PRESSURE FOR THE COMMANDER.

RUN	DAY	CODE	DATA	CON	-8	-16	-30	-40	-50	REC
1	357	1	PLVC	0.00	0.04	0.10	0.73	1.39	2.00	0.49
2	23	1	PLVC	0.00	-0.07	0.51	1.56	2.44	3.21	0.18
3	61	1	PLVC	0.00	0.06	0.12	1.26	1.75	2.56	-0.37
4	78	1	PLVC	0.00	0.05	0.52	1.43	2.42	3.34	0.85
5	106	1	PLVC	-0.00	0.50	0.95	1.67	2.53	3.03	0.99
6	131	1	PLVC	0.00	0.12	0.78	1.25	1.91	2.58	-0.32
7	149	2	PLVC	-0.00	1.27	2.47	3.99	5.19	6.60	1.22
8	153	2	PLVC	-0.00	1.45	2.55	4.07	5.35	6.66	0.76
9	156	2	PLVC	-0.00	1.19	2.18	3.38	4.08	5.11	0.08
10	160	2	PLVC	-0.00	1.10	1.64	2.58	3.55	4.70	0.95
11	163	2	PLVC	-0.00	1.30	2.17	3.17	4.07	5.14	1.13
12	166	2	PLVC	0.00	1.08	2.13	2.84	3.72	4.86	0.81
13	169	2	PLVC	0.00	0.99	2.10	3.98	4.84	6.09	1.25
14	173	3	PLVC	0.00	0.26	0.75	1.83	2.70	3.88	1.16
15	174	3	PLVC	-0.00	0.07	0.65	1.73	2.67	3.39	0.79
16	175	3	PLVC	0.00	0.19	1.34	3.34	4.31	5.15	-0.05
17	177	3	PLVC	0.00	0.59	1.33	2.08	3.09	4.21	1.46
18	181	3	PLVC	0.00	0.22	0.67	1.16	1.94	2.97	0.36
19	187	3	PLVC	0.00	0.16	0.82	1.80	2.39	2.88	0.46
20	193	3	PLVC	0.00	0.48	1.49	2.40	3.78	5.22	2.00
21	236	3	PLVC	0.00	0.01	0.27	0.95	1.49	2.02	-0.14

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TABLE 10. END OF PERIOD (EOP) VALUES OF PERCENTAGE CHANGE IN CALF VOLUME BY LEVEL OF NEGATIVE PRESSURE FOR THE SCIENTIST PILOT.

RUN	DAY	CODE	DATA	CON	-8	-16	-30	-40	-50	REC
1	357	1	PLVC	-0.00	0.26	0.88	2.74	3.37	3.84	0.05
2	26	1	PLVC	0.00	0.19	0.59	2.99	4.07	4.96	0.52
3	57	1	PLVC	0.00	0.02	0.30	2.61	4.32	5.15	0.36
4	78	1	PLVC	-0.00	0.58	0.59	3.35	4.80	5.84	0.46
5	106	1	PLVC	-0.00	0.09	1.15	3.36	4.66	5.62	0.36
6	131	1	PLVC	-0.00	0.41	1.03	3.10	4.23	5.03	-1.23
7	149	2	PLVC	-0.00	1.06	1.99	3.05	3.78	4.28	0.88
8	154	2	PLVC	0.00	1.96	3.32	5.66	7.36	8.77	2.48
9	157	2	PLVC	0.00	0.45	1.65	3.37	4.55	5.66	0.76
10	161	2	PLVC	-0.00	0.74	1.90	3.69	5.12	******	0.50
11	164	2	PLVC	-0.00	0.71	1.89	3.83	5.30	******	0.16
12	167	2	PLVC	-0.00	0.62	1.73	3.67	5.14	******	0.23
13	169	2	PLVC	-0.00	1.64	2.01	4.90	6.22	******	0.14
14	173	3	PLVC	0.00	-0.02	0.65	2.34	3.62	******	0.35
15	174	3	PLVC	0.00	0.06	0.99	2.22	3.04	******	0.72
16	175	3	PLVC	0.00	-0.02	0.68	2.68	3.59	******	0.36
17	178	3	PLVC	0.00	0.23	1.20	2.83	4.03	5.03	1.09
18	181	3	PLVC	0.00	0.04	1.24	3.04	3.82	4.65	0.60
19	187	3	PLVC	-0.00	0.36	1.77	3.59	4.71	5.74	1.01
20	197	3	PLVC	0.00	0.26	1.47	3.37	4.49	5.52	0.34
21	236	3	PLVC	-0.00	0.19	0.42	1.38	2.09	2.92	0.34

* Indicates data was not available or could not be calculated.

TABLE 11. END OF PERIOD (EOP) VALUES OF PERCENTAGE CHANGE IN CALF VOLUME BY LEVEL OF NEGATIVE PRESSURE FOR THE PILOT.

RUN	DAY	CODE	DATA	CON	-8	-16	-30	-40	-50	REC
1	357	1	PLVC	-0.00	0.12	0.77	1.81	2.66	3.65	1.21
2	30	1	PLVC	0.00	0.38	0.54	0.82	1.74	2.49	0.84
3	57	1	PLVC	0.00	0.23	0.66	1.94	3.06	3.99	1.45
4	78	1	PLVC	0.00	-0.01	0.16	0.98	1.75	2.48	0.75
5	106	1	PLVC	0.00	0.23	0.70	1.67	2.43	3.29	0.72
6	131	1	PLVC	0.00	0.19	0.55	1.77	2.92	3.87	1.28
7	148	2	PLVC	-0.00	1.73	2.79	4.09	4.93	5.86	0.93
8	151	2	PLVC	-0.00	1.24	2.19	3.37	4.15	5.10	0.89
9	155	2	PLVC	-0.00	1.14	2.25	4.08	5.09	6.12	0.58
10	159	2	PLVC	-0.00	1.40	1.88	3.37	4.33	5.30	0.62
12	165	2	PLVC	-0.00	2.52	3.97	5.82	******	******	1.40
13	168	2	PLVC	-0.00	1.90	3.06	4.71	5.77	******	1.02
14	171	2	PLVC	0.00	2.00	2.34	4.73	6.05	******	1.48
15	173	3	PLVC	0.00	0.19	0.62	1.32	2.00	2.71	0.95
16	174	3	PLVC	0.00	0.28	1.15	2.26	3.18	4.06	1.35
17	175	3	PLVC	0.00	0.10	0.98	2.71	4.61	6.13	2.30
18	178	3	PLVC	0.00	0.28	0.96	3.00	3.98	4.96	2.22
19	181	3	PLVC	0.00	0.27	1.33	2.75	3.60	4.61	1.29
20	186	3	PLVC	0.00	0.25	1.09	2.13	2.81	3.94	1.16
21	194	3	PLVC	0.00	0.27	1.16	2.67	3.73	4.79	1.23
22	236	3	PLVC	0.00	0.20	0.72	2.13	2.80	3.40	0.47

* Indicates data was not available or could not be calculated.

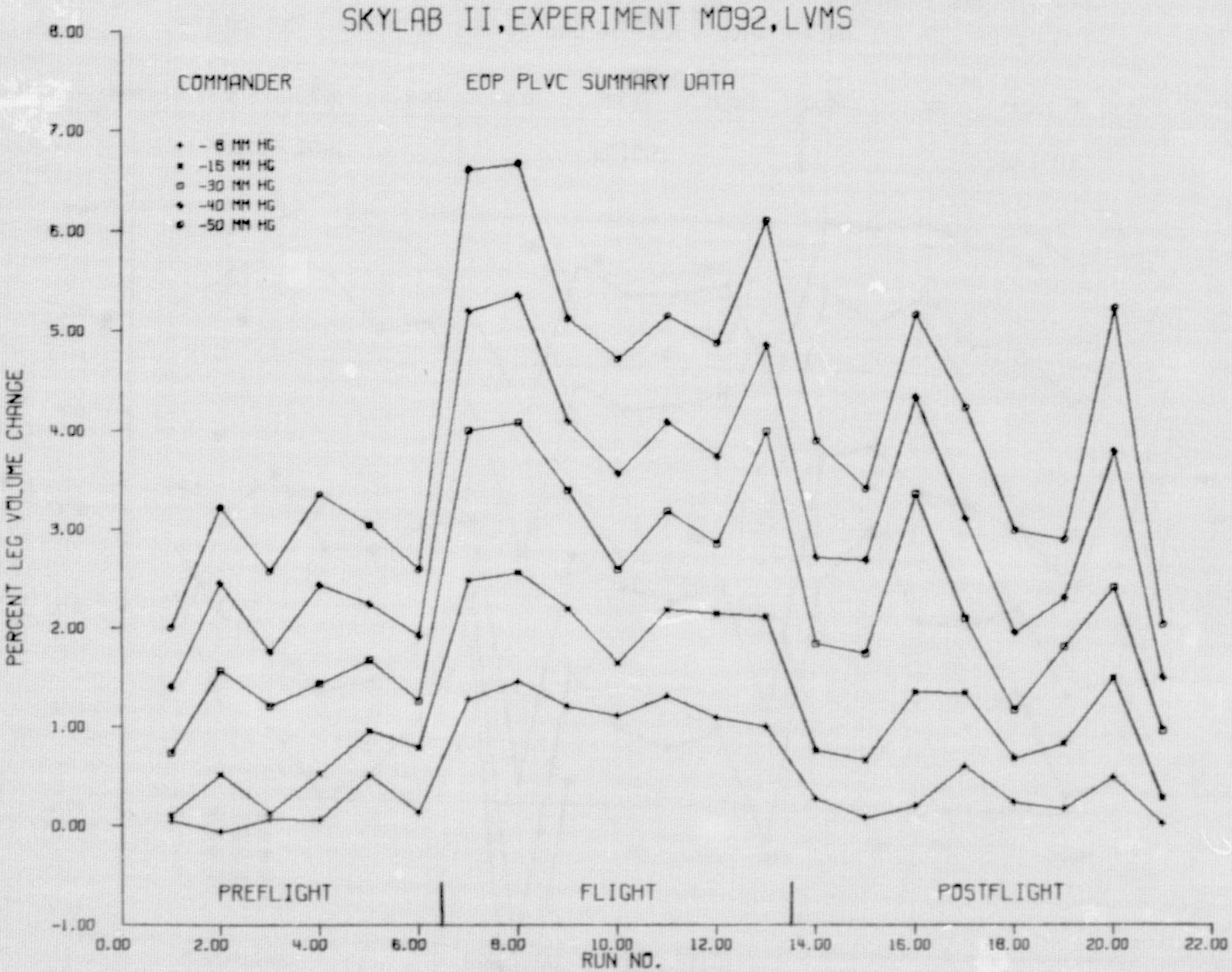

FIGURE 21. GRAPH OF END OF PERIOD (EOP) CALF VOLUME CHANGES AT EACH LEVEL OF NEGATIVE PRESSURE FOR EACH INDIVIDUAL EXPERIMENT.

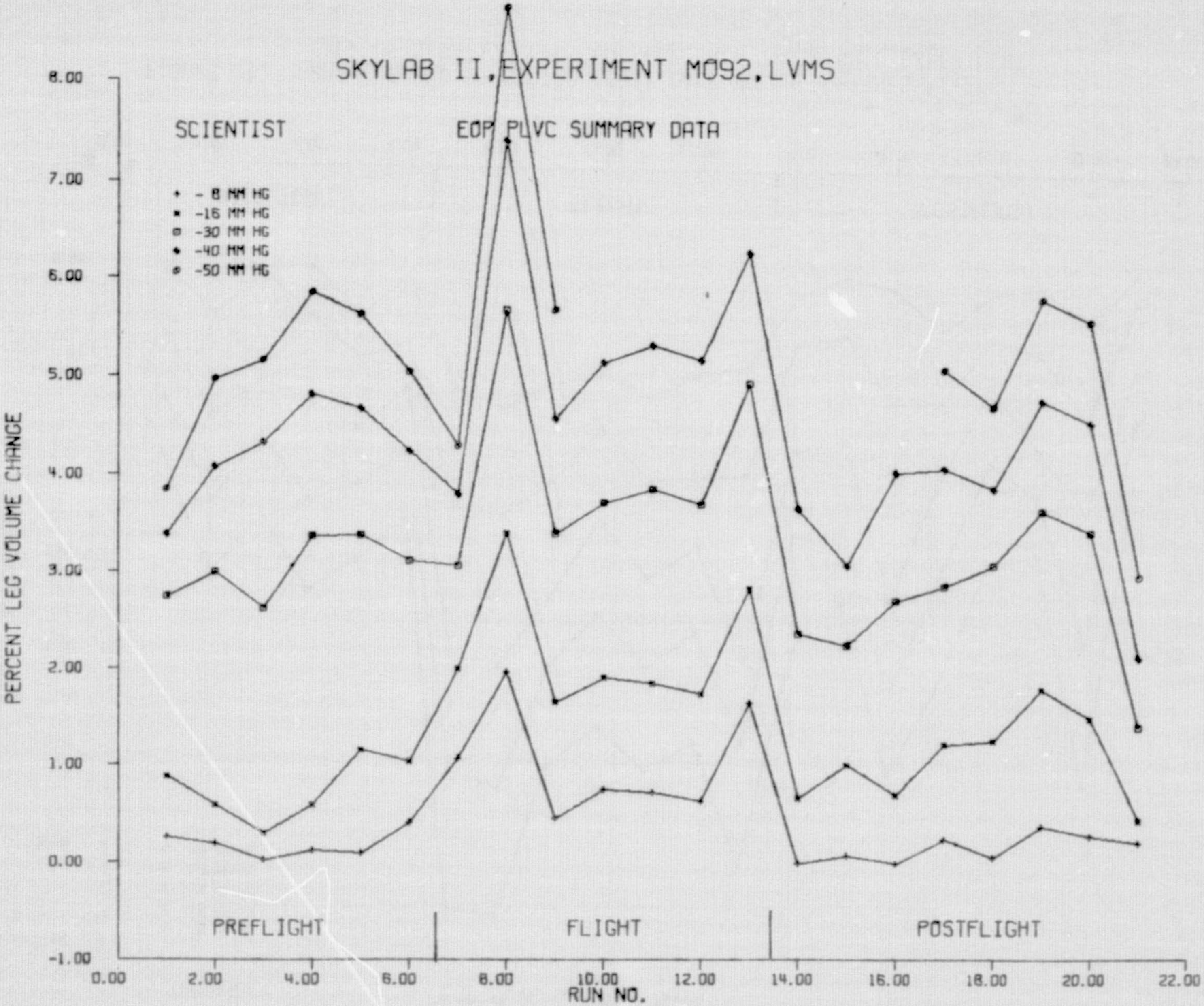

FIGURE 22. GRAPH OF END OF PERIOD (EOP) CALF VOLUME CHANGES AT EACH LEVEL OF NEGATIVE PRESSURE FOR EACH INDIVIDUAL EXPERIMENT.

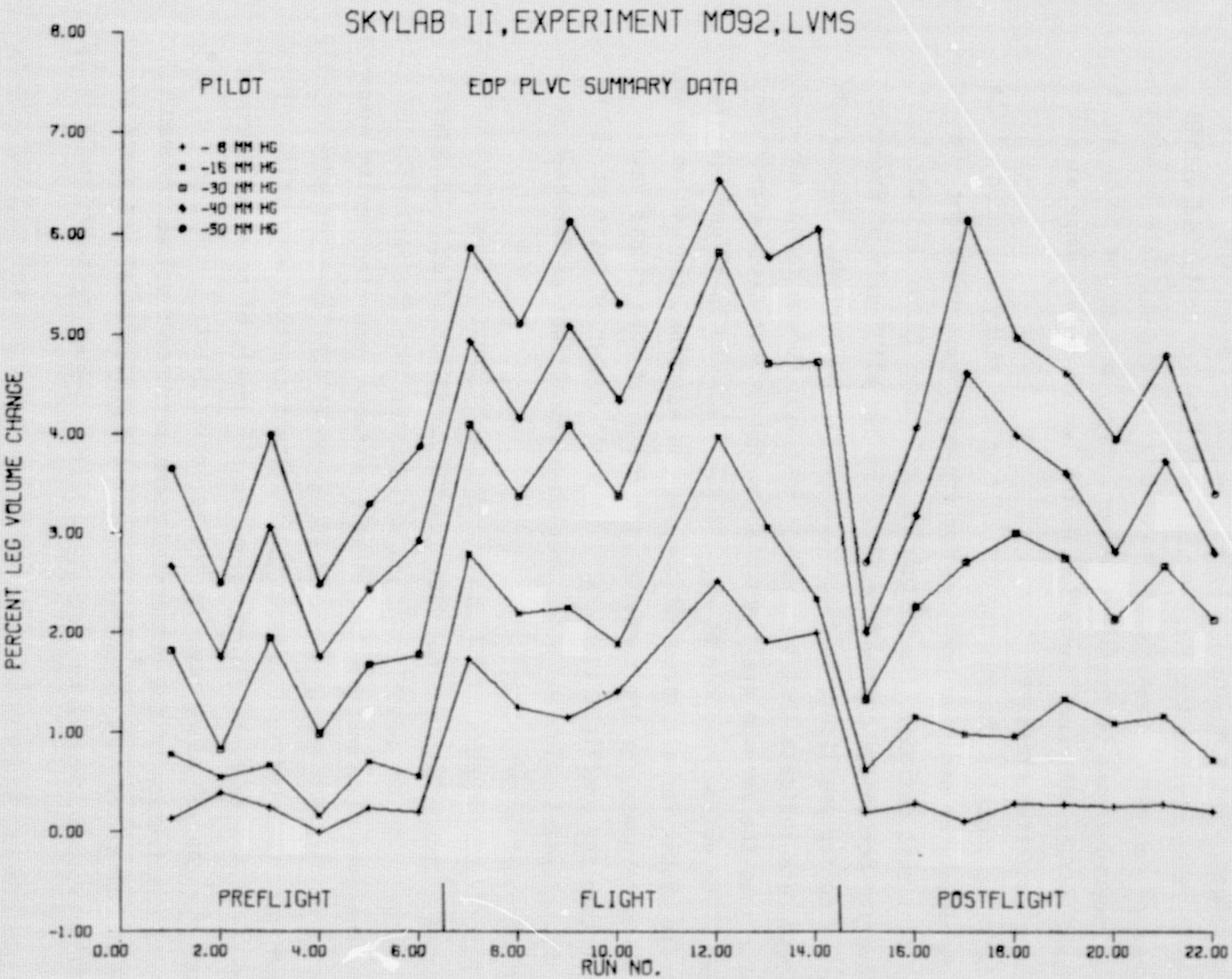

FIGURE 23. GRAPH OF END OF PERIOD (EOP) CALF VOLUME CHANGES AT EACH LEVEL OF NEGATIVE PRESSURE FOR EACH INDIVIDUAL EXPERIMENT.

The postflight data demonstrate an immediate return to approximate preflight values. While no in-flight data was collected for the first 4 or 5 days in zero-gravity, the first postflight data was collected within 10 hours of recovery. Even though the initial postflight data is dramatically reduced almost to preflight values, there does appear to be a "rebound" effect with much variation in the leg volume response at all levels of negative pressure.

Table 12 contains the average EOP calf volume changes induced by the various levels of negative pressure for the preflight, in-flight and postflight test periods. The histograms of Figures 24 to 26 indicate the average percentage change in calf volume for all levels of negative pressure during preflight, in-flight and postflight periods. Comparison of these data indicate that the average in-flight volume change was always greater than the average preflight changes and in most cases significantly higher. The volume response at -8, -16 and -30 mm Hg in-flight was significantly higher for all three astronauts. In addition, the -40 mm Hg and -50 mm Hg response for the commander and the pilot were significantly higher than the preflight averages. The small number of tests at -50 mm Hg for the scientist pilot and pilot precluded significant differences at that level of negative pressure.

Postflight averages of EOP PLVC tended to be greater than the preflight averages although this was not true for the scientist pilot. In general, the variation in the postflight data was greater than the variation in preflight data illustrating the slightly unstable condition due to readaptation to the gravity gradient. Even though postflight averages were usually higher than the preflight values, the in-flight averages were still significantly higher than postflight values at all levels of negative pressure except for the -50 mm Hg level on the scientist pilot.

The realization of the pronounced increase in calf volume induced by LNBP is emphasized more dramatically by the compilation of the ratio of in-flight volume changes compared to preflight values as shown in Table 13.

TABLE 12. SUMMARY OF PERCENTAGE CHANGE IN CALF VOLUME INDUCED BY LEVELS OF LOWER BODY NEGATIVE PRESSURE.

SUBJECT	EXPR CODE	Average Percentage Change in Leg Volume, ± S. D., and Number of Runs at Indicated Levels of Pressure					
		-8	-16	-30	-40	-50	R
CDR	Preflight	.12 ± .20 6	.50 ± .34 6	1.31 ± .33 6	2.02 ± .42 6	2.79 ± .50 6	.30 ± .58 6
CDR	In-flight	1.20 ± .16 7	2.18 ± .29 7	3.43 .60 7	4.40 .72 7	5.59 .83 7	.89 .40 7
CDR	Postflight	.25 ± .20 8	.92 ± .43 8	1.91 ± .74 8	2.78 ± .93 8	3.72 ±1.12 8	.76 .75 8
SPT	Preflight	.18 ± .14 6	.76 ± .32 6	3.03 ± .31 6	4.24 ± .51 6	5.07 ± .70 6	.09 ± .67 6
SPT	In-flight	1.03 ± .57 7	2.19 ± .65 7	4.02 ± .92 7	5.35 ±1.15 7	6.53 ±3.17 2	.74 ± .82 7
SPT	Postflight	.14 ± .14 8	1.05 ± .46 8	2.68 ± .70 8	3.74 ± .90 7	4.77 ±1.12 5	.63 .29 8
PLT	Preflight	.19 ± .13 6	.56 ± .22 6	1.50 ± .47 6	2.43 ± .57 6	3.30 ± .67 6	1.04 ± .31 6
PLT	In-flight	1.70 ± .49 7	2.64 ± .71 7	4.31 ± .86 7	5.05 ± .76 6	5.60 ± .48 4	.99 ± .35 7
PLT	Postflight	.23 ± .06 8	1.00 ± .24 8	2.37 ± .53 8	3.34 ± .81 8	4.33 ±1.04 8	1.37 ± .61 8

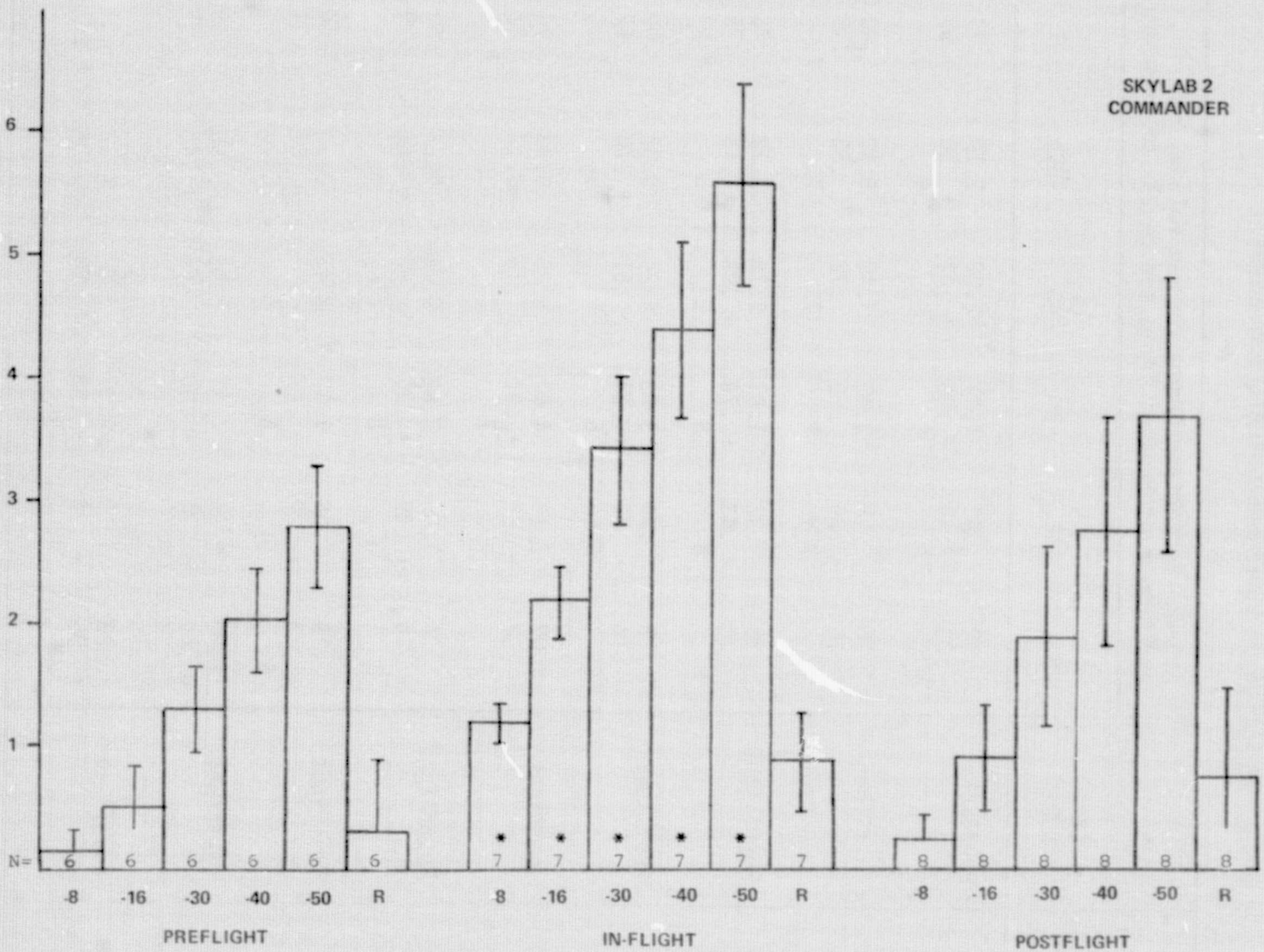

FIGURE 24. HISTOGRAMS SHOWING AVERAGE (± 1S.D.) PERCENTAGE CHANGE IN CALF VOLUME FOR ALL LEVELS OF NEGATIVE PRESSURE.

* Indicates significant differences ($P<0.05$) from preflight.

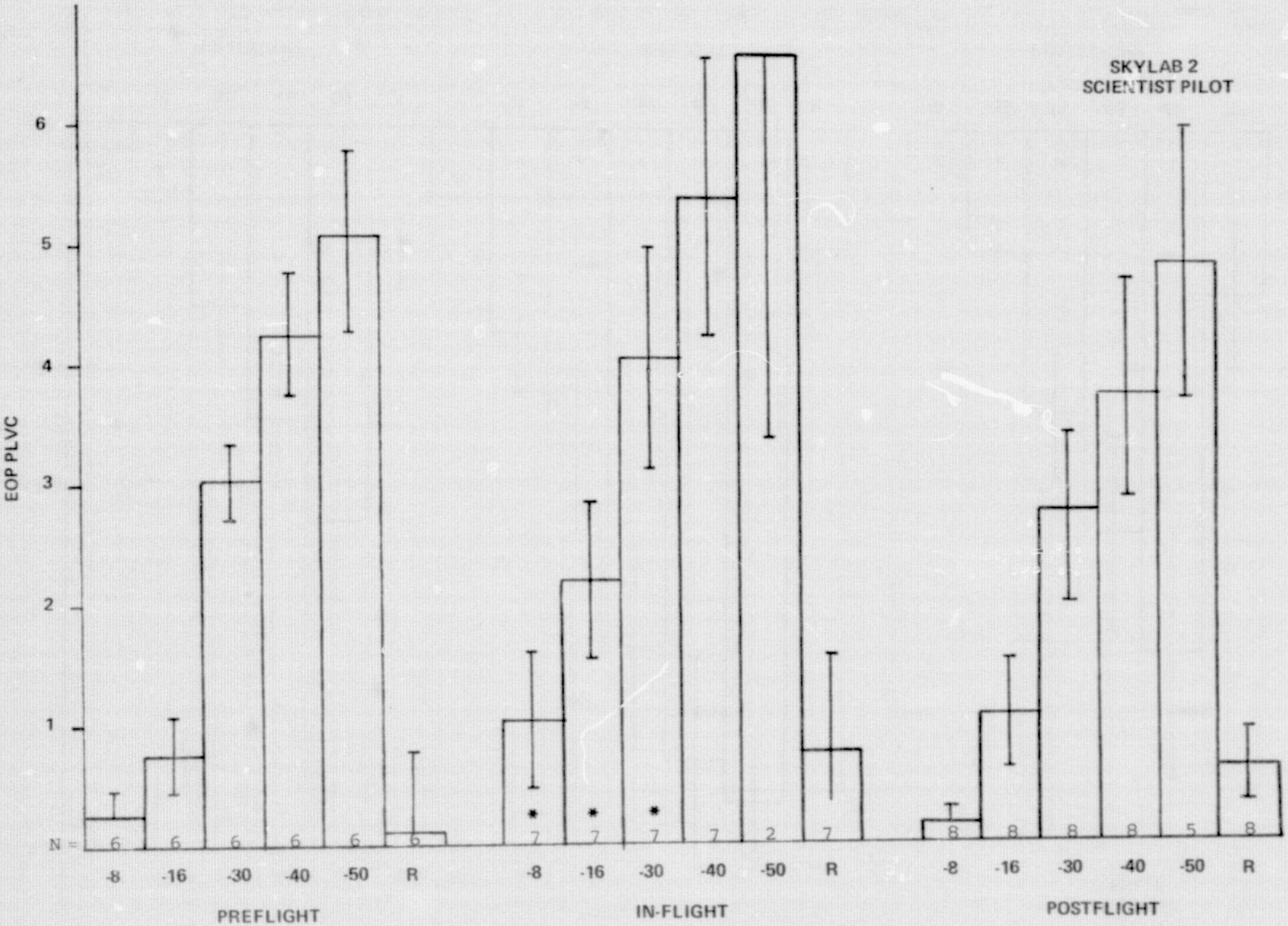

FIGURE 25. HISTOGRAMS SHOWING AVERAGE ($\pm$ 1 S.D.) PERCENTAGE CHANGE IN CALF VOLUME FOR ALL LEVELS OF NEGATIVE PRESSURE.
* Indicates significant differences (P<0.05) from preflight.

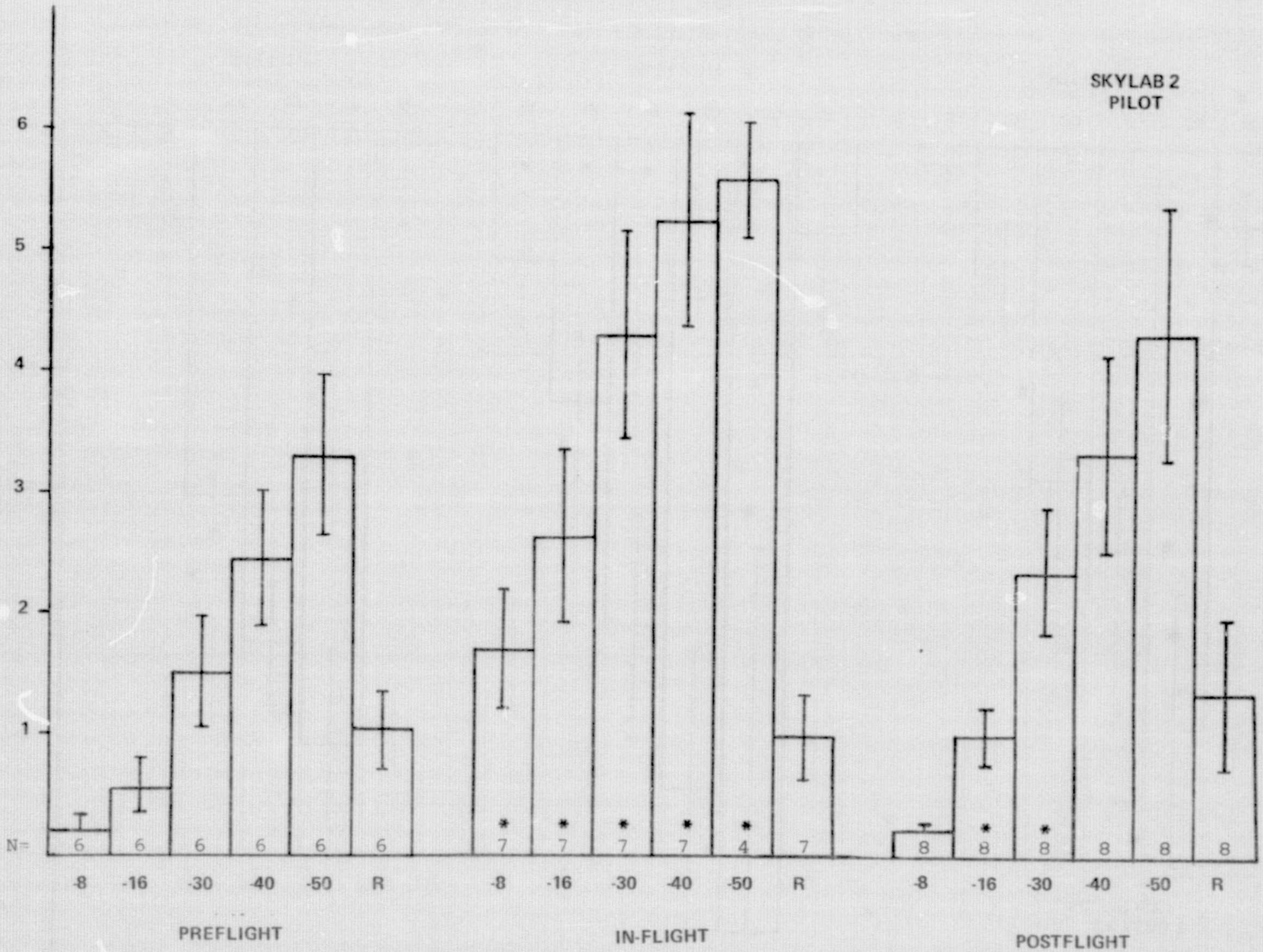

FIGURE 26. HISTOGRAMS SHOWING AVERAGE ($\pm$ 1 S.D.) PERCENTAGE CHANGE IN CALF VOLUME FOR ALL LEVELS OF NEGATIVE PRESSURE.
* Indicates significant differences ($P<0.05$) from preflight.

TABLE 13 - RATIO OF INFLIGHT AND POSTFLIGHT VOLUME CHANGE IN COMPARISON TO PREFLIGHT VALUE

SUBJECT	EXPR CODE	Ratio of Average Calf Volume Change Inflight and Postflight Compared to Average Preflight Changes at Indicated Levels of Pressure					
		-8	-16	-30	-40	-50	REC
CDR	In-flight	10.0	4.4	2.6	2.2	2.0	3.0
CDR	Postflight	2.1	1.8	1.5	.5	1.3	2.5
SPT	In-flight	4.0	2.9	1.3	1.3	1.3	8.2
SPT	Postflight	.5	1.4	.9	.9	.9	6.7
PLT	In-flight	8.9	4.7	2.9	2.2	1.7	1.0
PLT	Postflight	1.2	1.8	1.6	1.4	1.3	1.3
GROUP	In-flight	7.6	4.0	2.3	1.9	1.7	4.1
Mean	Postflight	1.3	1.7	1.3	.9	1.2	3.5

This illustrates where the in-flight volume changes are occurring relative to the levels of the LBNP protocol used. There is an approximate eight-fold increase in volume change at the -8 mm Hg level of negative pressure decreasing down to an average 1.7 fold increase at the -50 mm Hg level. The individual and average data is graphically displayed in Figure 27. The fact that such huge percentage increases in calf volume are observed at -8 mm Hg negative pressure supports the theory that the leg veins in weightlessness prior to application of negative pressure were considerably more empty than they were prior to the preflight 1G LBNP tests. While the in-flight data demonstrate an approximate 800% increase in the volume change occurring at -8 mm Hg negative pressure compared to preflight values this actually represents a volume shift of approximately 1% increase in calf volume over the preflight value. The fact that the preflight -8 mm Hg LBNP response was very small makes the 1% in-flight increase appear very overwhelming. The average increase in magnitude over the preflight values for each level of negative pressure is tabulated in Table 14. While computation of a ratio or percentage difference comparison of the -8 mm Hg level of preflight to in-flight leg volume response is misleading due to the fact that the -8 mm Hg PLVC preflight data is approximately zero, the data difference tabulated in Table 14 allows an accurate comparison of preflight and in-flight data at the low levels of negative pressure. These data and the graphic display of Figure 28 illustrate that approximately 50% of the increased volume change observed in the Skylab 2 astronauts occurred during the -8 mm Hg level of negative pressure and that another 28% increase occurred at the -16 mm Hg level. The remaining increase occurred slowly during the -30 to -50 mm Hg levels of negative pressure.

<u>Slope of the Change in Calf Volume</u>

In order to perfectly characterize and compare the nature of the calf volume response induced by various levels of negative pressure, it is necessary to consider the rate of change in calf volume. If one assumes that the rapidly occurring change in a leg exposed to a change in negative

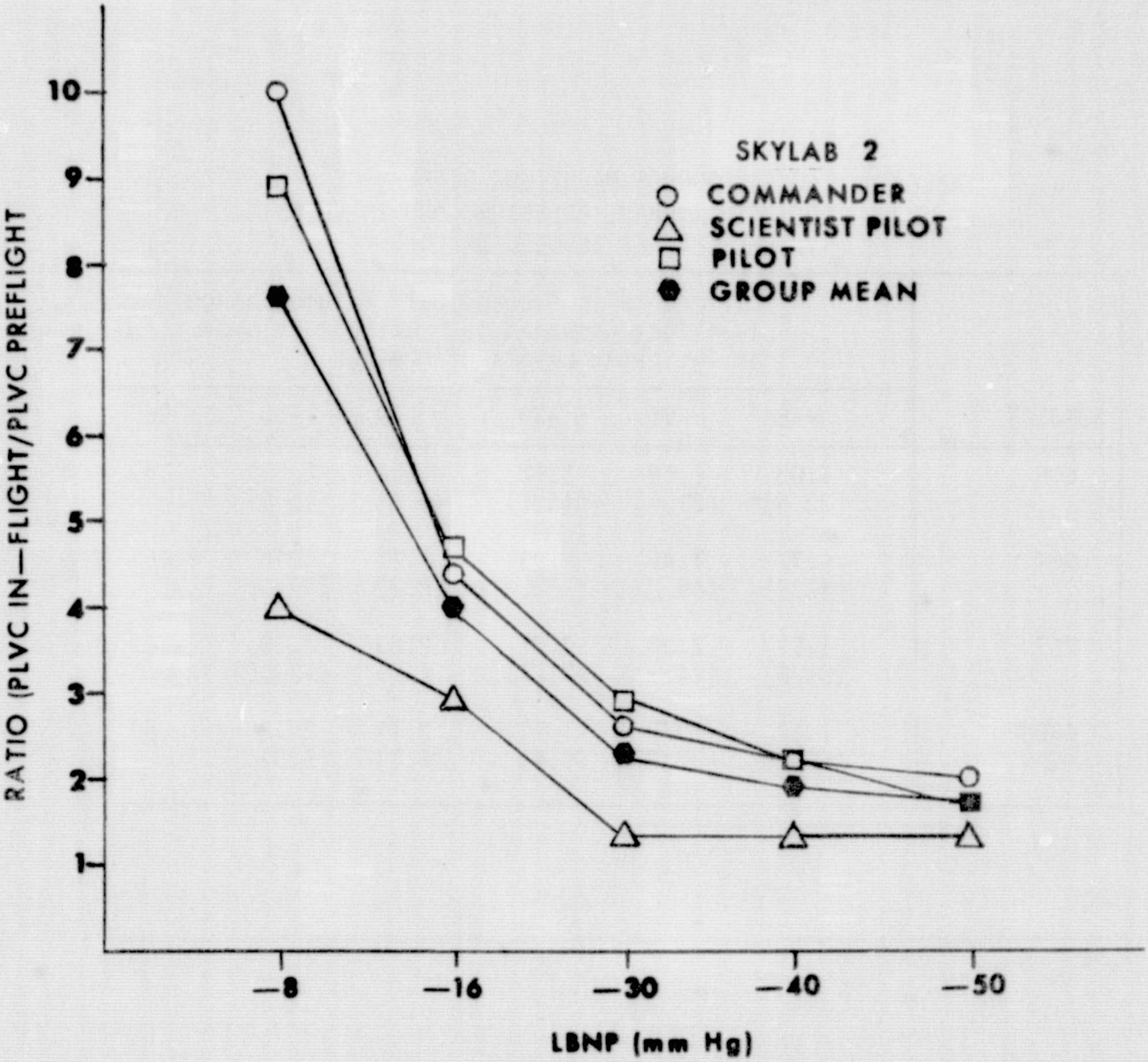

FIGURE 27. RATIO OF AVERAGE CALF VOLUME CHANGE (IN-FLIGHT/PREFLIGHT) AT EACH LEVEL OF NEGATIVE PRESSURE.

TABLE 14. COMPARISON OF MAGNITUDE DIFFERENCE BETWEEN AVERAGE PREFLIGHT AND IN-FLIGHT VOLUME CHANGES INDUCED BY LBNP.

	Difference in Average Calf Volume Change In-flight Compared to Preflight Volume at Indicated Levels of Pressure					
SUBJECT	-8	-16	-30	-40	-50	REC
CDR	1.08 (38.6)*	1.68 (21.4)	2.12 (15.7)	2.38 (9.3)	2.80 (15.0)	.59
SPT	.77 (52.7)	1.43 (45.2)	.99 (-30.2)	1.11 (8.2)	1.46 (24.0)	.65
PLT	1.51 (65.6)	2.08 (24.8)	2.81 (31.7)	2.83 (.9)	2.30 (-23.0)	-.05
GROUP MEAN	1.12 (52.3)	1.73 (27.8)	1.97 (9.4)	2.11 (6.1)	2.19 (5.3)	.40

* Numbers within parentheses indicate percentage of magnitude difference occurring at each level of negative pressure.

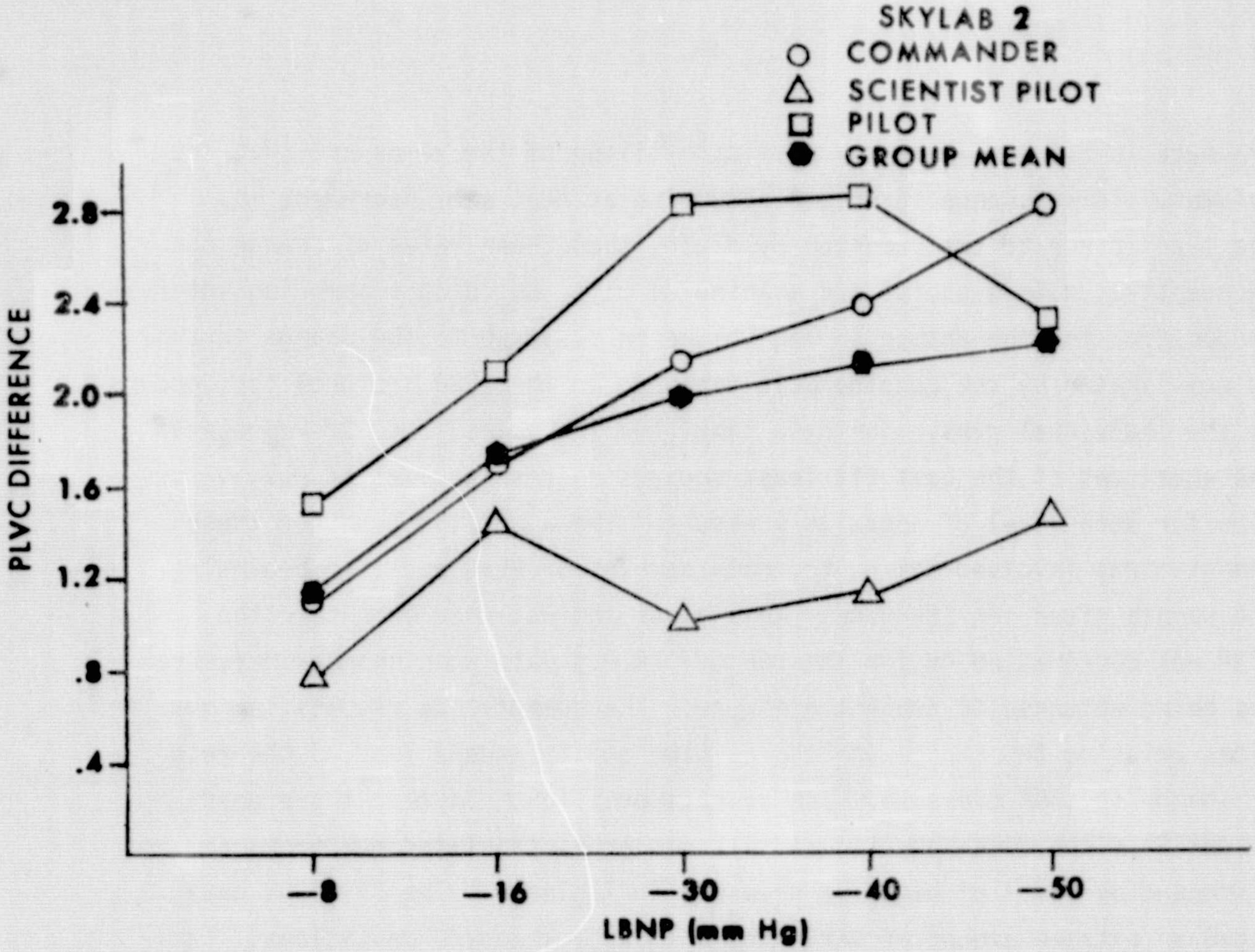

FIGURE 28. DIFFERENCE IN PLVC BETWEEN AVERAGE PREFLIGHT AND IN-FLIGHT CALF VOLUME CHANGE AT EACH LEVEL OF NEGATIVE PRESSURE.

pressure is due mostly to the physical filling of the veins and that the delayed, slower change in volume occurring at that same decrement in pressure is due to transudation of fluid, then these rates of change can be quantitated in a useful and meaningful way. Choosing a sampling interval or duration for the change in leg volume in response to the change in LBNP is complicated by the considerable variance in the LBNP protocol that occurs in the individual runs. The data tabulated in Tables 15 to 17 represents the equations of the best fit least squares regression line of PLVC versus time for each level of negative pressure. The algorithm used for these computations involved taking ten data samples of PLVC and time beginning one sample after the EOP time. This algorithm was used each time the LBNP was decremented or for the run off (R.O.) data when chamber pressure was being returned to ambient pressure. The computation results in equations relating the change in PLVC to time and is independent of the rate of change in LBNP pressure. The average preflight, in-flight and post-flight S1 slope data computed in this manner is tabulated for each astronaut by level of negative pressure in Table 18. The S1 slope data shows an extreme amount of variation and large standard deviations, partially because of the capricious nature of the system, but mostly due to the fact that this type of computation does not consider the rate and magnitude variation in negative pressure. The graphical display of the average S1 slope values and the results of the comparison of average pre-flight and in-flight values are shown in Figures 29 to 31. The average S1 slope values as shown on the preflight histograms indicate a common pattern for all three astronauts although there is considerable variation. The average slopes demonstrate an increasing magnitude until the peak slope value is reached for all astronauts during the change in negative pressure to -30 mm Hg. At the -40 and -50 mm Hg pressure decrements the S1 slopes indicate decreasing slope values more comparable to that obtained in the earlier portion of the LBNP protocol. The recovery or run off slope values as read from the axes of the right side of the graphs indicate large values varying from 6 to 18 percent leg volume change per minute.

TABLE 15. EQUATIONS FOR THE BEST FIT REGRESSION LINE OF PLVC VERSUS TIME FOR THE S1 SLOPE OF CALF VOLUME AT ALL LEVELS OF NEGATIVE PRESSURE (COMMANDER).

RUN	DAY	CODE	DATA	NSAMP	-8		-16		-30		-40		-50		R.C.	
					B0	B1	B0	B1	B0	B1	B0	B1	B0	B1	B0	B1
1	357	1	S1	10	-1.020	0.220	-3.782	0.667	-15.825	2.289	-16.466	1.714	-16.411	1.190	17.989	-0.800
2	25	1	S1	10	1.449	-0.268	-18.039	3.020	-24.193	3.571	-15.958	1.746	-16.412	1.267	94.178	-4.557
3	61	1	S1	10	-0.989	0.428	-3.850	1.206	-18.349	2.930	-12.760	1.526	-17.157	1.548	81.381	-4.570
4	78	1	S1	10	-1.715	0.358	-13.216	2.250	-26.118	2.578	-12.475	1.409	-10.978	0.909	245.262	-12.169
5	106	1	S1	10	-11.109	2.199	-3.617	0.719	-18.317	1.906	-10.505	1.212	-8.588	0.721	238.139	-11.826
6	131	1	S1	10	-4.728	0.973	-12.429	2.115	-8.659	0.808	-11.825	1.297	-8.310	0.691	110.995	-5.434
7	149	[illegible]	S1	10	-17.693	3.540	-20.365	3.571	-16.101	2.766	-16.586	2.109	-9.082	0.990	599.718	-30.091
8	153	2	S1	10	-18.807	3.814	-19.001	3.448	-21.738	3.527	-8.623	1.279	-25.422	2.071	511.734	-25.342
9	156	2	S1	10	-2.338	0.408	-5.448	1.113	-5.356	1.080	-3.353	0.878	-19.614	1.578	72.686	-3.382
10	160	2	S1	10	-8.688	1.739	-9.086	1.705	-3.742	0.770	-0.952	0.358	-3.232	0.457	143.744	-6.947
11	163	2	S1	10	-30.999	6.228	-8.129	1.583	0.523	0.252	-9.567	1.277	-12.782	1.129	71.493	-3.324
12	166	2	S1	10	-6.988	1.399	-8.159	1.600	-8.230	1.496	-9.511	1.230	-18.291	1.483	16.432	-0.579
13	169	2	S1	10	-7.724	1.571	-4.309	0.906	-7.363	1.345	4.010	0.000	-17.372	1.488	82.319	-3.822
14	173	3	S1	10	2.200	-0.418	-6.787	1.178	-17.338	2.516	-6.613	0.842	-7.485	0.683	84.621	-4.028
15	174	3	S1	10	-7.614	1.530	-16.116	2.709	-17.379	2.574	-12.195	1.392	-16.630	1.288	54.215	-2.539
16	175	3	S1	10	-3.873	0.727	-34.064	5.735	-56.049	8.228	-21.627	2.867	-11.119	1.037	164.247	-7.954
17	177	3	S1	10	-12.515	2.603	-14.567	2.201	-16.276	2.525	-18.558	2.133	-9.895	0.879	101.919	-4.881
18	181	3	S1	10	-8.860	1.800	-14.149	2.070	-11.818	1.804	-12.939	1.472	-12.291	0.958	103.002	-4.995
19	187	3	S1	10	0.305	0.000	-21.592	3.639	-25.864	3.835	-15.887	1.785	-16.865	1.287	122.386	-5.968
20	193	3	S1	10	-14.293	2.896	-31.567	5.360	-15.715	3.040	-19.655	2.275	-19.833	1.580	125.204	-5.991
21	236	3	S1	10	-0.788	0.168	-10.443	1.760	-14.905	2.185	-13.521	1.480	-17.789	1.291	242.661	-12.081

TABLE 16. EQUATIONS FOR THE BEST FIT REGRESSION LINE OF PLVC VERSUS TIME FOR THE S1 SLOPE OF CALF VOLUME AT ALL LEVELS OF NEGATIVE PRESSURE (SCIENTIST PILOT).

FLT	DAY	CODE	DATA	NSAMP	-8		-16		-30		-40		-50		R.C.	
					B0	B1	B0	B1	B0	B1	B0	B1	B0	B1	B0	B1
1	357	1	S1	10	-1.053	0.300	-8.164	1.809	-22.093	2.979	-18.810	2.688	-18.530	1.591	35.753	-1.491
2	76	1	S1	10	-4.869	0.986	-12.892	2.206	-46.133	5.846	-25.604	2.879	-26.242	2.168	444.139	-22.029
3	87	1	S1	10	-3.859	0.778	-11.133	1.906	-32.685	4.701	-38.231	4.170	-35.073	2.669	296.327	-14.361
4	78	1	S1	10	-5.164	1.065	-14.580	2.504	-34.912	5.052	-28.522	2.222	-30.408	2.371	124.593	-5.944
5	106	1	S1	10	-7.539	0.532	-21.927	3.682	-44.680	6.158	-30.070	3.360	-31.813	2.428	737.930	-36.703
6	131	1	S1	10	-17.766	2.563	-19.271	3.313	-45.632	6.725	-28.519	3.180	-32.898	2.080	565.898	-28.193
7	109	2	S1	10	-8.974	1.817	-15.175	2.673	-18.770	2.100	-6.354	0.933	-7.306	0.738	305.602	-15.085
8	184	2	S1	10	-15.889	3.259	-12.087	2.395	-11.529	2.103	-18.750	2.481	-27.866	2.341	530.214	-26.130
9	157	2	S1	10	-7.838	1.531	-18.170	3.090	-2.470	0.598	-13.767	1.714	-11.138	1.053	351.921	-18.672
10	161	2	S1	10	-17.848	2.608	-13.670	2.437	-5.432	1.635	-14.556	1.842	*******	*******	54.309	-2.436
11	164	2	S1	10	-15.811	3.171	-15.836	3.261	-13.157	2.194	-10.570	1.811	*******	*******	10.612	-0.233
12	168	2	S1	10	-7.429	1.501	-13.876	2.413	-7.715	1.266	-12.815	1.781	*******	*******	38.342	-1.634
13	169	2	S1	10	-17.299	3.501	-0.495	1.686	-5.738	1.809	-19.253	2.497	*******	*******	434.453	-24.124
14	173	3	S1	10	-5.072	1.042	-43.734	7.366	-10.550	1.831	-14.456	1.709	*******	*******	175.784	-12.868
15	174	3	S1	10	5.494	-1.013	-11.236	1.692	-5.437	1.520	-14.644	1.651	*******	*******	81.506	-3.904
16	179	3	S1	10	-0.219	0.078	-17.534	2.998	-36.024	5.228	-20.133	2.288	*******	*******	158.140	-7.671
17	178	3	S1	10	-8.659	1.758	-24.598	3.881	-22.751	3.432	-22.981	2.592	-19.043	1.548	185.493	-9.020
18	181	3	S1	10	-1.198	0.263	-26.131	4.363	-26.236	3.928	-18.560	2.182	-22.560	1.769	151.554	-7.337
19	187	3	S1	10	-8.418	1.710	-31.905	5.390	-26.485	4.040	-23.675	2.771	-22.335	1.802	147.637	-7.080
20	197	3	S1	10	-2.135	0.492	-37.413	6.204	-48.195	6.253	-33.407	3.888	-39.820	2.960	136.651	-6.561
21	236	3	S1	10	-7.594	0.521	-8.775	1.502	-21.858	3.194	-15.851	1.727	-10.868	0.867	219.044	-10.846

TABLE 17. EQUATIONS FOR THE BEST FIT REGRESSION LINE OF PLVC VERSUS TIME FOR THE S1 SLOPE OF CALF VOLUME AT ALL LEVELS OF NEGATIVE PRESSURE (PILOT).

BLK	DAY	CODE	DATA	NSAMP	-8		-16		-30		-40		-50		R.O.	
					B0	B1	B0	B1	B0	B1	B0	B1	B0	B1	B0	B1
1	357	1	S1	10	-5.462	1.101	-14.430	2.450	-31.953	4.670	-29.265	3.100	-17.976	1.384	128.649	-6.199
2	30	1	S1	10	-2.047	0.430	-0.586	0.242	-5.765	0.500	-14.680	1.506	0.348	0.099	149.509	-7.384
3	57	1	S1	10	-5.808	1.379	-10.641	1.849	-38.316	5.641	-24.958	2.717	-23.759	1.807	316.518	-15.732
4	78	1	S1	10	-2.402	0.498	-7.520	1.352	-28.353	3.377	-17.301	1.858	-17.087	1.264	91.280	-4.458
5	108	1	S1	10	-0.625	0.168	-13.489	2.317	-21.738	3.246	-12.164	1.395	-11.318	0.920	340.206	-16.912
6	171	1	S1	10	-3.839	0.729	-7.189	1.276	-39.744	4.567	-15.939	1.793	-17.763	1.391	290.765	-14.416
7	148	2	S1	10	-16.799	3.308	-11.875	2.315	-14.878	2.550	7.587	-0.308	-9.528	0.968	13.161	-0.369
8	151	2	S1	10	-21.078	4.274	-14.252	2.626	-18.637	2.096	-3.942	0.758	-10.577	0.583	13.470	-0.424
9	155	2	S1	10	-35.023	7.608	-13.576	2.662	-21.600	3.566	-22.093	2.801	-17.515	1.536	43.796	-1.911
10	159	2	S1	10	-4.413	0.827	-5.563	1.081	-5.618	1.084	-5.576	0.800	-0.849	0.351	55.003	-2.501
12	165	2	S1	10	-17.867	4.484	-25.601	5.975	-17.051	3.501	3.157	0.257	*******	*******	50.477	-2.302
13	168	2	S1	10	-20.900	4.197	-2.054	0.668	-20.191	3.214	-0.984	0.543	*******	*******	28.780	-1.180
14	171	2	S1	10	-7.789	1.804	-4.657	1.153	-27.797	4.254	-9.163	1.015	*******	*******	68.557	-3.104
15	173	3	S1	10	-6.151	1.252	-15.618	2.617	-14.416	2.139	-2.282	0.365	-7.426	0.629	42.590	-1.992
16	174	3	S1	10	-12.232	2.268	-12.598	2.437	-28.577	3.703	-10.146	1.326	-10.197	0.933	51.521	-2.442
17	175	3	S1	10	-5.708	1.167	-28.749	4.842	-35.454	5.797	-16.586	1.692	-26.648	2.115	78.496	-3.612
18	178	3	S1	10	-9.631	1.571	-20.588	3.559	-66.691	9.671	-10.605	1.373	-16.401	1.372	51.670	-2.328
19	181	3	S1	10	-1.098	0.309	-29.317	4.973	-36.002	5.324	-24.652	2.760	-18.027	1.458	67.767	-3.154
20	186	3	S1	10	-10.418	2.112	-20.096	3.419	-24.975	3.741	-17.774	2.001	-16.171	1.273	56.955	-2.645
21	184	3	S1	10	-5.018	1.843	-25.894	4.390	-51.029	7.484	-28.865	3.143	-25.764	1.975	65.512	-3.032
22	236	3	S1	10	-6.128	1.259	-18.250	3.119	-46.567	6.808	-16.445	1.875	-13.267	1.080	390.010	-19.377

TABLE 18. SUMMARY OF S1 SLOPE (PLVC PER MINUTE) CHANGES INDUCED BY LEVELS OF LOWER BODY NEGATIVE PRESSURE.

SUBJECT	EXPR CODE	Average S1 Slope Change in Leg Volume, ± S. D. and Number of Runs at Indicated Levels of Pressure					
		-8	-16	-30	-40	-50	R
CDR	Preflight	.65 ± .86 6	1.66 .95 6	2.41 .98 6	1.55 .29 6	1.05 .33 6	-6.56 4.51 6
CDR	In-flight	2.77 ±1.92 7	1.99 1.08 7	1.61 1.15 7	.99 .70 7	1.31 .51 7	-10.50 11.99 7
CDR	Postflight	1.17 ±1.23 8	3.08 1.68 8	3.35 2.06 8	1.72 .55 8	1.12 .29 8	-6.05 2.90 8
SPT	Preflight	1.04 ± .81 6	2.57 .77 6	5.42 1.01 6	3.21 .57 6	2.28 .38 6	-18.12 13.42 6
SPT	In-flight	2.48 ± .86 7	2.57 .52 7	1.67 .57 7	1.78 .54 7	1.38 .85 7	-12.62 11.07 7
SPT	Postflight	.60 ± .92 8	4.21 2.07 8	3.66 1.62 8	2.32 .68 8	1.79 .76 8	-8.16 2.75 8
PLT	Preflight	.70 ± .41 6	1.60 .81 6	3.80 1.70 6	2.07 .68 6	1.14 .59 6	-10.85 5.44 6
PLT	In-flight	3.71 ±2.03 7	2.35 1.79 7	2.90 1.07 7	.86 .91 7	.96 .48 7	-1.68 1.06 7
PLT	Postflight	1.57 ± .73 8	3.67 .97 8	5.58 2.41 8	1.86 .87 8	1.35 .50 8	-4.82 5.90 8

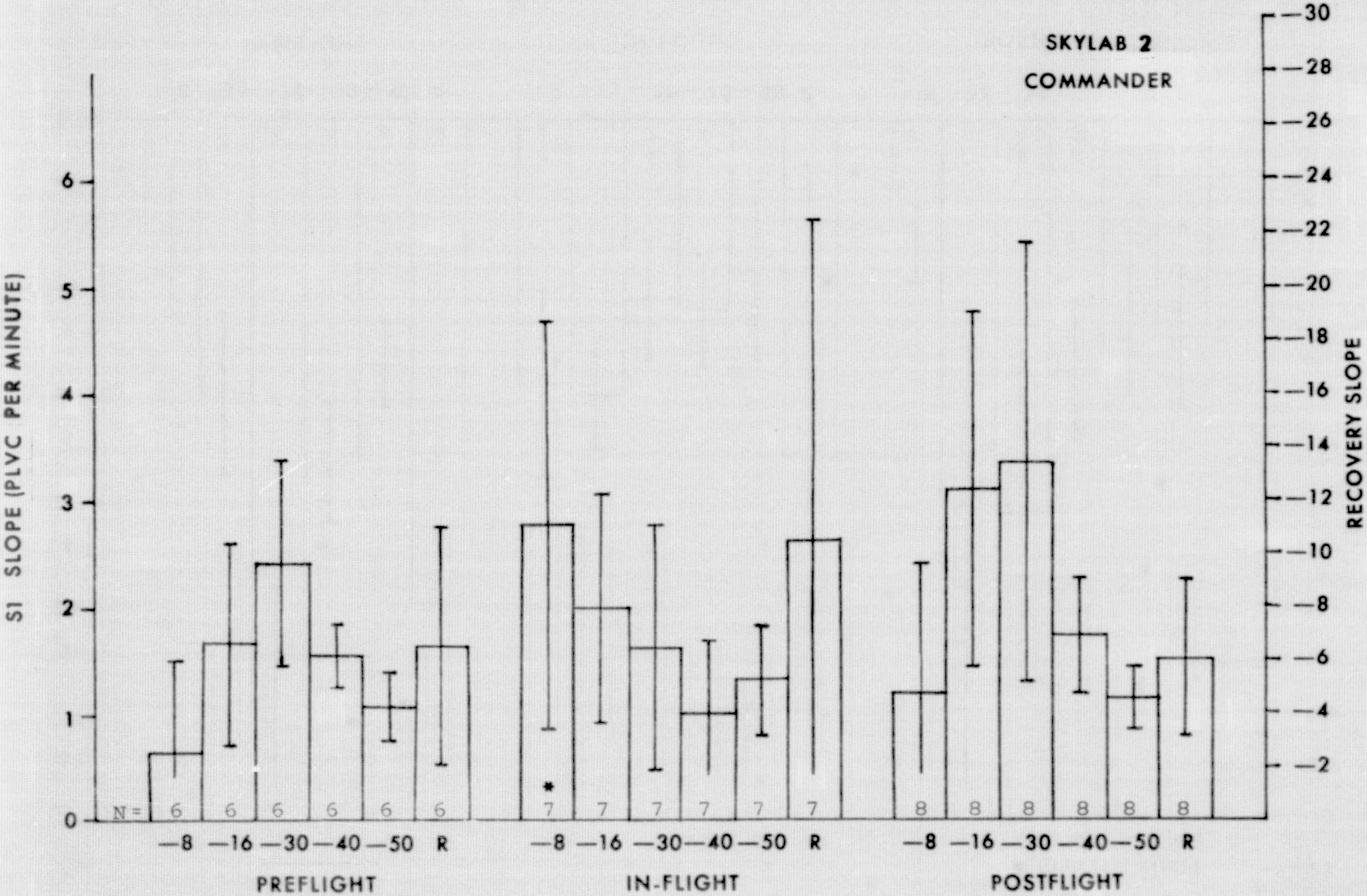

FIGURE 29. HISTOGRAMS SHOWING AVERAGE S1 SLOPE VALUES (± 1 S.D.) FOR ALL LEVELS OF NEGATIVE PRESSURE.
* Indicates a significant difference (P<0.05) from preflight.

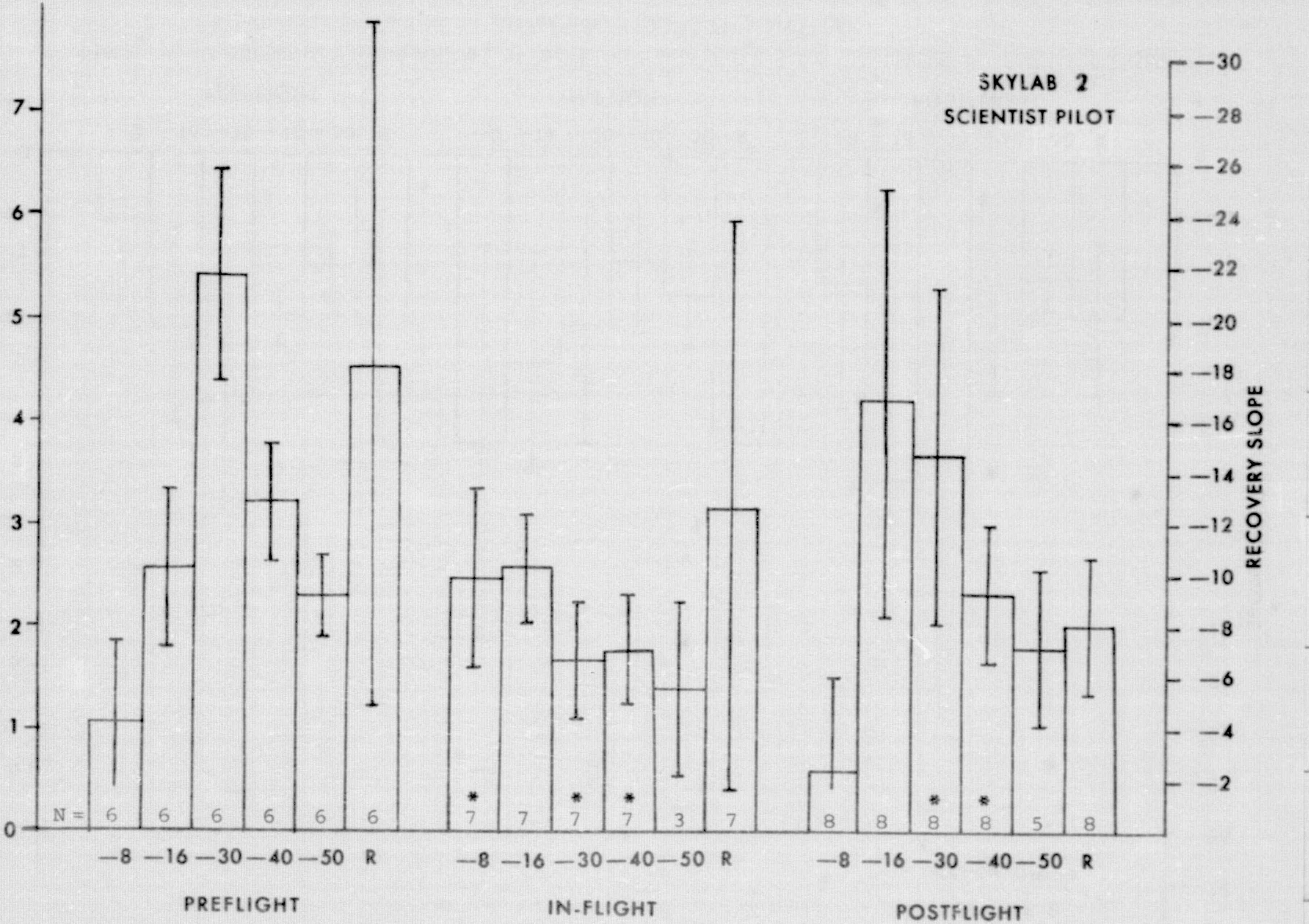

FIGURE 30. HISTOGRAMS SHOWING AVERAGE S1 SLOPE VALUES ($\pm$ 1 S.D.) FOR ALL LEVELS OF NEGATIVE PRESSURE.

* Indicates a significant difference ($P<0.05$) from preflight.

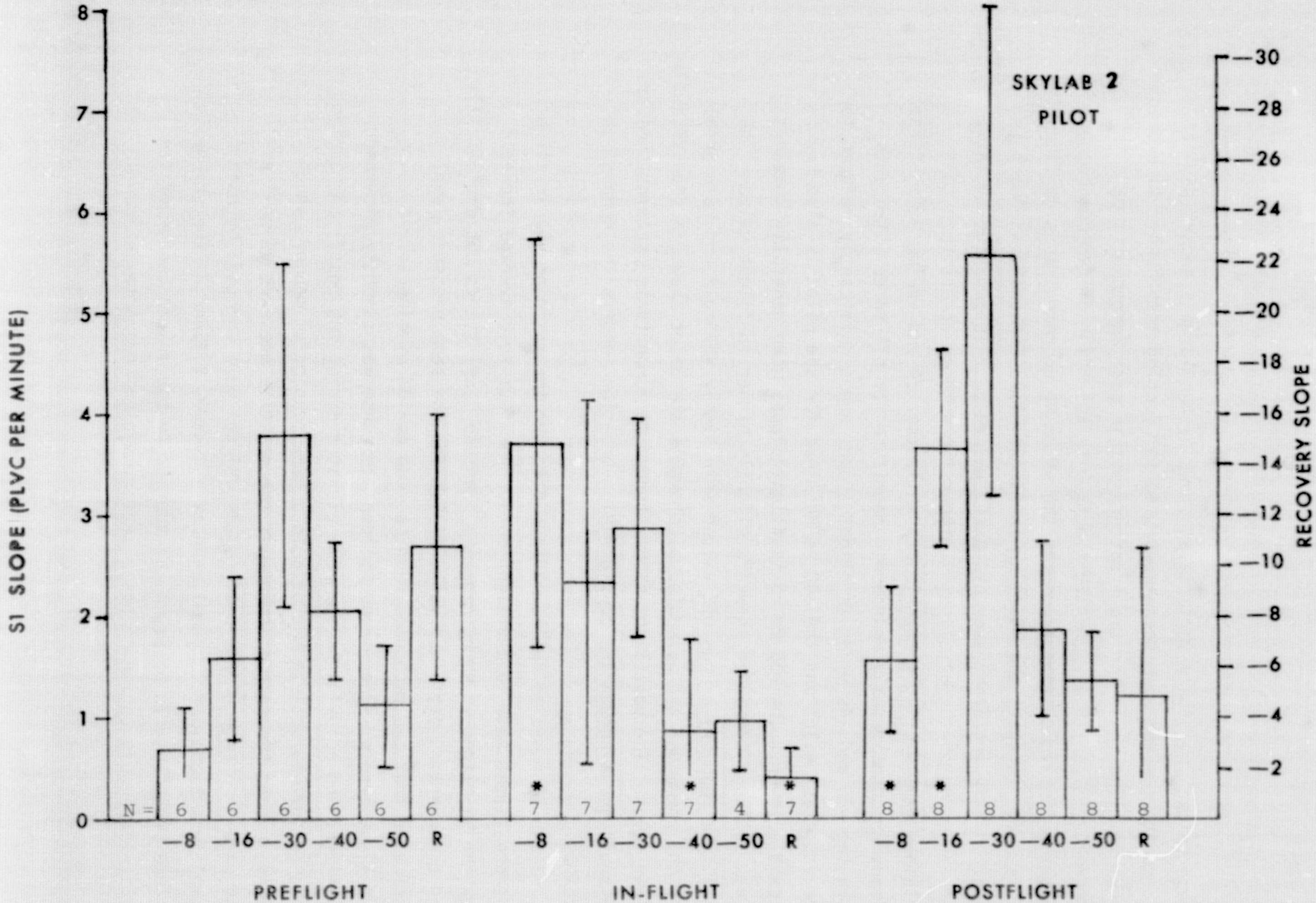

FIGURE 31. HISTOGRAMS SHOWING AVERAGE S1 SLOPE VALUES ($\pm$ 1 S.D.) FOR ALL LEVELS OF NEGATIVE PRESSURE.
* Indicates a significant difference (P<0.05) from preflight.

These values are highly variable as shown by the large standard deviations and due to the variable techniques used for venting the chamber to ambient pressure. The in-flight slope pattern within each astronaut's data is somewhat similar to his preflight data with the major difference being that the in-flight slope value for the -8 mm Hg decrement is significantly increased. In fact, the -8 mm Hg in-flight slope for each astronaut is significantly increased over his preflight value. In addition to this, the -16 mm Hg in-flight slope is either the same or larger than that obtained from preflight experiments while the -30 and -40 mm Hg in-flight slopes are considerably reduced in magnitude for all three astronauts. Both the -30 and -40 mm Hg in-flight slopes are significantly reduced for the scientist pilot and the -40 mm Hg slope for the pilot is also significantly lower. The -50 mm Hg in-flight slopes were generally somewhat lower although commander showed a slightly higher in-flight value. The in-flight recovery or run off values were highly variable and were greater for the commander and scientist pilot while the pilot showed a significantly lower value. The postflight slopes tended to demonstrate patterns similar to preflight although the considerable variation renders the comparison tenuous.

Table 19 contains the comparison data for the ratio of the in-flight and postflight data to preflight data. The four-fold average increase for the in-flight -8 mm Hg negative pressure level stands out dramatically and the average postflight value of 1.6 for the same pressure level indicates that the responses require some period of time to return to preflight levels. The -16 mm Hg level response was slightly elevated in-flight and actually became more elevated during the postflight period. In an effort to analyze the data in a more meaningful manner, which would include the rate of change of the negative pressure as well as the rate of change of the calf volume, slopes were computed by using compliance techniques. Compliance of a system, defined as the change in volume per change in pressure, as applied to the volume change of the calf allows computation of basic pressure-volume characteristics.

TABLE 19. RATIO OF IN-FLIGHT AND POSTFLIGHT S1 SLOPE DATA COMPARED TO THE PREFLIGHT BASELINE DATA.

CREW MEMBER	IN-FLIGHT						POSTFLIGHT					
	-8	-16	-30	-40	-50	R	-8	-16	-30	-40	-50	R
CDR	4.3	1.2	.7	.6	1.2	1.6	1.8	1.9	1.4	1.1	1.0	.9
SPT	2.4	1.0	.3	.6	.6	.7	.6	1.6	.7	.7	.8	.5
PLT	5.3	1.5	.8	.4	.8	.2	2.3	2.3	1.5	.9	1.2	.4
GRP MEAN	4.0	1.2	.6	.5	.9	.8	1.6	1.9	1.2	.9	1.0	.6

Assessment of pressure-volume properties relates to the characteristics of the overall calf segment and not solely to the intrinsic properties of the veins. Certainly the pressure-volume characteristics of the deep veins will be more affected by surrounding tissue than will the superficial veins. However, in an effort to more adequately characterize the volume changes occurring at the calf, a measure of compliance was calculated. The compliance equations were calculated using the PLVC and LBNP data beginning with the first data point during the interval of change in negative pressure. The algorithm used for this computation involved sampling the negative pressure to determine if the pressure change was complete at which time no more samples would be analyzed. If the pressure change for the standard decrements of -8 to -50 mm Hg was not complete in ten samples or if the pressure change associated with the run off was not complete in 25 samples, the sampling was stopped. At this point, the equation of the best fit, least squares regression was computed. This data is tabulated in Tables 20 through 22 for all three crewmembers. The tables indicate the intercept (B0), the slope (B1) and the number of samples (in parenthesis) for each level of negative pressure. While these data still show considerable variation among runs, the slope is now expressed as a function of the rate of change in negative pressure. The

TABLE 20. EQUATIONS FOR THE BEST FIT REGRESSION LINE OF PLVC VERSUS NEGATIVE PRESSURE (COMPLIANCE) FOR THE S1 SLOPE OF CALF VOLUME AT ALL LEVELS OF NEGATIVE PRESSURE (COMMANDER).

RUN	DAY	CODE	-8		-16		-30		-40		-50		P.O.	
			B0	B1	B0	B1	B0	B1	B0	B1	B0	B1	B0	B1
1	357	1	-0.025	-0.017(5)	-0.054	-0.010(10)	-0.322	-0.022(5)	0.203	-0.017(6)	0.699	-0.018(5)	0.436	-0.032(3)
2	25	1	0.066	0.045(9)	-0.790	-0.068(8)	-0.083	-0.035(8)	0.975	-0.020(5)	1.769	-0.019(9)	1.260	-0.046(25)
3	61	1	-0.015	-0.049(10)	-0.089	-0.015(9)	-0.420	-0.030(10)	0.437	-0.024(10)	0.797	-0.024(8)	1.200	-0.049(13)
4	78	1	0.029	-0.048(5)	-0.133	-0.025(7)	0.164	-0.021(9)	1.002	-0.015(6)	1.832	-0.016(5)	2.000	-0.033(6)
5	106	1	-0.203	-0.034(6)	0.928	0.033(5)	0.498	-0.018(6)	1.277	-0.007(5)	2.002	-0.003(6)	2.880	-0.017(4)
6	131	1	0.059	-0.050(5)	-0.203	-0.036(5)	0.998	-0.000(6)	1.042	-0.009(5)	1.557	-0.011(8)	0.946	-0.040(23)
7	149	2	-0.142	-0.039(5)	0.576	-0.052(5)	1.942	-0.027(6)	3.708	-0.008(6)	3.963	-0.028(10)	3.430	-0.077(11)
8	153	2	0.094	-0.048(5)	1.446	-0.010(5)	2.105	-0.030(8)	3.746	-0.013(9)	4.874	-0.015(5)	3.790	-0.073(11)
9	156	2	-0.025	-0.040(5)	0.988	-0.020(5)	2.079	-0.008(7)	3.062	-0.010(6)	3.413	-0.015(7)	3.437	-0.038(25)
10	160	2	-0.066	-0.047(10)	1.057	-0.008(5)	1.403	-0.012(8)	2.492	-0.004(6)	3.339	-0.007(10)	3.190	-0.034(16)
11	163	2	-0.073	-0.039(5)	1.086	-0.028(6)	2.367	0.004(8)	3.025	-0.008(6)	3.454	-0.015(8)	3.603	-0.037(25)
12	166	2	0.002	-0.003(5)	0.905	-0.025(7)	1.923	-0.011(9)	2.395	-0.018(7)	3.043	-0.017(8)	3.787	-0.024(25)
13	169	2	0.090	-0.013(7)	1.013	-0.007(6)	2.071	-0.015(10)	4.010	-0.008(5)	3.920	-0.023(6)	3.865	-0.004(5)
14	173	3	0.084	-0.048(5)	0.107	-0.021(5)	0.321	-0.025(9)	1.481	-0.018(7)	2.619	-0.004(5)	2.766	-0.027(25)
15	174	3	-0.003	-0.014(5)	-0.387	-0.051(7)	0.255	-0.023(8)	1.165	-0.018(7)	2.072	-0.014(5)	2.483	-0.021(25)
16	175	3	0.229	0.012(5)	-1.145	-0.131(10)	0.150	-0.074(7)	2.151	-0.038(6)	4.043	-0.009(6)	2.382	-0.077(25)
17	177	3	0.315	-0.041(5)	0.279	-0.032(5)	0.964	-0.023(8)	1.321	-0.028(6)	2.338	-0.021(10)	2.814	-0.039(25)
18	181	3	0.078	-0.019(5)	0.008	-0.025(5)	0.590	-0.012(5)	0.683	-0.018(5)	1.512	-0.012(5)	1.390	-0.040(25)
19	187	3	0.587	0.045(5)	-0.389	-0.052(5)	0.422	-0.029(5)	1.304	-0.028(6)	1.439	-0.022(5)	1.836	-0.037(25)
20	193	3	0.114	-0.047(5)	-0.019	-0.061(5)	0.912	-0.033(7)	1.453	-0.032(6)	3.304	-0.014(5)	3.987	-0.049(25)
21	236	3	0.081	-0.044(5)	-0.174	-0.023(7)	0.032	-0.015(7)	0.629	-0.013(7)	0.956	-0.014(6)	0.723	-0.049(5)

TABLE 21. EQUATIONS FOR THE BEST FIT REGRESSION LINE OF PLVC VERSUS NEGATIVE PRESSURE (COMPLIANCE) FOR THE S1 SLOPE OF CALF VOLUME AT ALL LEVELS OF NEGATIVE PRESSURE (SCIENTIST PILOT).

RUN	DAY	CODE	-8 B0	-8 B1	-16 B0	-16 B1	-30 B0	-30 B1	-40 B0	-40 B1	-50 B0	-50 B1	R.D. B0	R.D. B1
1	357	1	0.026	-0.010(5)	0.132	-0.017(5)	0.429	-0.031(8)	2.097	-0.020(6)	2.872	-0.012(6)	1.745	-0.044(25)
2	26	1	0.035	-0.016(6)	0.062	-0.029(8)	-0.154	-0.050(10)	2.066	-0.033(10)	2.999	-0.031(10)	2.206	-0.075(6)
3	57	1	-0.005	-0.048(5)	-0.189	-0.021(6)	-0.314	-0.041(10)	1.557	-0.036(6)	3.601	-0.019(5)	1.292	-0.006(25)
4	78	1	-0.044	-0.040(5)	-0.175	-0.035(7)	-0.205	-0.043(10)	1.871	-0.048(10)	3.297	-0.037(10)	1.715	-0.042(25)
5	106	1	0.021	-0.017(5)	-0.380	-0.047(7)	0.389	-0.045(9)	2.109	-0.042(8)	3.863	-0.021(7)	2.253	-0.003(10)
6	131	1	-0.495	-0.118(6)	0.081	-0.036(6)	0.141	-0.051(10)	1.623	-0.046(8)	2.777	-0.035(10)	1.747	-0.045(5)
7	149	2	0.007	-0.068(5)	0.656	-0.044(8)	1.582	-0.021(7)	2.736	-0.009(5)	3.377	-0.009(8)	2.587	-0.039(13)
8	154	2	0.420	-0.044(5)	1.693	-0.044(5)	3.243	-0.017(8)	4.664	-0.037(6)	5.676	-0.041(8)	5.830	-0.074(12)
9	157	2	-0.124	-0.032(6)	0.010	-0.040(6)	1.710	-0.002(7)	2.814	-0.018(5)	4.061	-0.013(9)	3.471	-0.056(13)
10	161	2	0.122	-0.020(7)	0.539	-0.027(7)	1.595	-0.017(10)	3.017	-0.023(10)	*******	********(5)	4.141	-0.040(25)
11	164	2	0.034	-0.042(5)	0.514	-0.027(5)	1.670	-0.014(8)	3.213	-0.028(8)	*******	********(5)	8.630	-0.034(25)
12	167	2	0.010	-0.061(7)	0.432	-0.018(5)	1.531	-0.009(8)	2.884	-0.024(8)	*******	********(5)	4.157	-0.040(25)
13	169	2	0.039	-0.032(5)	1.507	-0.009(5)	2.769	-0.007(6)	3.739	-0.035(10)	*******	********(5)	3.897	-0.007(11)
14	173	3	0.081	-0.047(7)	-0.831	-0.089(5)	0.593	-0.012(8)	1.573	-0.027(5)	*******	********(5)	2.092	-0.072(6)
15	174	3	0.288	0.045(5)	-0.020	-0.022(5)	0.875	-0.016(8)	1.669	-0.019(7)	*******	********(5)	1.955	-0.044(25)
16	175	3	0.034	-0.064(5)	-0.366	-0.041(6)	-0.071	-0.048(9)	1.825	-0.030(9)	*******	********(5)	1.749	-0.003(25)
17	178	3	0.446	0.040(5)	-0.143	-0.045(6)	0.791	-0.025(7)	1.835	-0.030(9)	3.354	-0.019(10)	2.647	-0.004(25)
18	181	3	0.007	-0.013(5)	-0.393	-0.047(6)	0.514	-0.041(10)	2.496	-0.018(5)	3.338	-0.014(5)	2.118	-0.005(25)
19	187	3	-0.110	-0.042(5)	-0.149	-0.059(5)	1.325	-0.027(5)	2.792	-0.026(6)	3.891	-0.021(9)	3.093	-0.004(25)
20	197	3	0.355	0.042(5)	-0.383	-0.062(5)	0.596	-0.047(8)	2.280	-0.035(6)	3.676	-0.020(5)	2.304	-0.051(25)
21	236	3	-0.026	-0.011(5)	0.025	-0.016(5)	0.083	-0.019(7)	0.931	-0.014(5)	1.789	-0.008(5)	1.446	-0.042(6)

TABLE 22. EQUATIONS FOR THE BEST FIT REGRESSION LINE OF PLVC VERSUS NEGATIVE PRESSURE (COMPLIANCE) FOR THE S1 SLOPE OF CALF VOLUME AT ALL LEVELS OF NEGATIVE PRESSURE (PILOT).

RUN	DAY	CODE	-8 B0	-8 B1	-16 B0	-16 B1	-30 B0	-30 B1	-40 B0	-40 B1	-50 B0	-50 B1	R.O. B0	R.O. B1
1	357	1	0.009	-0.017(9)	-0.174	-0.033(5)	0.071	-0.039(8)	0.707	-0.033(8)	1.706	-0.023(10)	1.784	-0.044(25)
2	30	1	0.083	-0.007(9)	0.455	-0.002(7)	0.422	-0.006(9)	0.346	-0.014(5)	1.214	-0.014(7)	1.786	-0.016(5)
3	57	1	0.037	-0.066(8)	0.083	-0.025(8)	-0.451	-0.060(9)	0.497	-0.045(10)	2.036	-0.026(9)	2.108	-0.042(7)
4	78	1	0.048	-0.044(5)	-0.176	-0.018(8)	-0.205	-0.023(7)	0.263	-0.022(5)	0.797	-0.022(6)	1.092	-0.033(25)
5	106	1	0.030	-0.065(6)	-0.075	-0.034(6)	0.242	-0.025(7)	1.088	-0.019(9)	2.011	-0.010(6)	1.564	-0.059(9)
6	131	1	0.006	-0.062(5)	-0.082	-0.038(5)	-0.056	-0.036(5)	0.863	-0.020(9)	2.361	-0.015(5)	2.349	-0.037(6)
7	148	2	0.044	-0.104(8)	1.447	-0.033(5)	2.197	-0.029(10)	4.438	0.009(7)	4.613	-0.008(8)	5.046	-0.016(25)
8	151	2	-0.105	-0.000(6)	0.729	-0.051(8)	1.784	-0.018(10)	3.185	-0.008(5)	3.662	-0.011(7)	4.090	-0.020(25)
9	155	2	0.020	-0.033(5)	0.718	-0.043(8)	1.768	-0.031(10)	3.217	-0.024(8)	4.756	-0.008(7)	3.965	-0.043(25)
10	159	2	0.201	-0.002(5)	1.418	0.003(5)	1.636	-0.014(10)	3.038	-0.016(7)	4.239	-0.004(10)	4.264	-0.021(25)
12	165	2	0.186	-0.048(5)	2.123	-0.052(7)	3.485	-0.028(8)	5.806	-0.002(6)	*******	*******(0)	5.093	-0.048(25)
13	168	2	-0.071	-0.046(5)	1.936	-0.005(8)	2.811	-0.021(6)	4.747	0.000(6)	*******	*******(5)	4.187	-0.001(25)
14	171	2	-0.028	-0.037(10)	*******	*******(0)	2.064	-0.031(6)	4.555	-0.010(5)	*******	*******(5)	4.980	-0.056(20)
15	173	3	-0.069	-0.037(5)	-0.385	-0.044(8)	0.215	-0.019(9)	1.200	-0.006(6)	1.617	-0.009(10)	2.087	-0.015(15)
16	174	3	-0.142	-0.036(5)	-0.232	-0.066(7)	0.477	-0.035(9)	1.714	-0.019(7)	2.691	-0.013(7)	3.176	-0.021(25)
17	175	3	0.279	0.045(5)	-0.465	-0.070(6)	0.516	-0.034(6)	2.111	-0.025(5)	3.881	-0.021(5)	4.844	-0.030(25)
18	178	3	0.084	-0.026(5)	-0.151	-0.052(5)	0.305	-0.045(5)	2.634	-0.016(5)	3.354	-0.019(5)	3.987	-0.025(25)
19	181	3	-0.105	-0.004(5)	-0.276	-0.068(6)	0.596	-0.044(7)	1.642	-0.038(5)	3.399	-0.010(5)	3.248	-0.032(25)
20	186	3	0.031	-0.041(9)	-0.291	-0.058(6)	0.571	-0.035(8)	1.787	-0.015(7)	2.306	-0.014(7)	3.992	-0.024(25)
21	194	3	0.050	-0.031(5)	-0.378	-0.071(5)	0.172	-0.059(6)	1.351	-0.042(8)	3.035	-0.019(5)	3.087	-0.042(25)
22	236	3	0.082	-0.032(6)	-0.172	-0.052(5)	-0.192	-0.058(6)	1.430	-0.025(7)	2.065	-0.019(7)	1.494	-0.050(7)

effect of this computation is to decrease some of the slope values such as the -30 mm Hg values which on previous slope computations were exaggerated because of the 14 mm change in pressure rather than the usual 8 or 10 mm Hg change. The average preflight, in-flight and postflight compliance values are tabulated for each crewmember in Table 23 and graphed as histograms in Figures 32 to 34. The individual crewmembers' preflight pattern are somewhat similar although the scientist pilot had much larger compliance values. The in-flight compliance changes were not dramatic except for the increased values at -8 mm Hg for both the commander and the pilot. There appeared to be decreased in-flight compliance values at the -30, -40 and -50 mm Hg negative pressure levels. The -40 mm Hg compliance value was significantly lower than preflight values for all three crewmembers. The -30 mm Hg value for the scientist pilot and the -50 mm Hg value for the pilot were also significantly lower than preflight values. Postflight values at the -16 mm Hg negative pressure level indicated a dramatic increase in compliance value for all three crewmembers. The comparison of the average compliance values for the various mission phases is tabulated in Table 24 where the values indicate the ratio of preflight values to the compliance values of in-flight and postflight data.

The S1 slope is represented by the rate of change in calf volume while the negative pressure is changing. The S2 slope is the rate of change in calf volume occurring after a change in negative pressure and for the period of time while the negative pressure is constant. The algorithm used for the Skylab data involved computing regression lines for PLVC versus time using a specific amount of time for negative pressure, control or recovery periods. The times and samples are listed by period in Table 25. The individual S2 slope data (PLVC/Minute) for each crewmember are tabulated in Tables 26 through 28. The average data tabulated in Table 29 and graphed by mission phase in Figures 35 through 37 demonstrate the severe variation occurring in the S2 slope data. The preflight values demonstrate no particular pattern with the possible exception of lower slope values for the -8 mm Hg negative pressure and the recovery period. The average in-flight

TABLE 23. SUMMARY OF S1 SLOPE COMPLIANCE (PLVC/mm Hg) CHANGES INDUCED BY LOWER BODY NEGATIVE PRESSURE.

SUBJECT	EXPR CODE	Average S1 Slope Compliance Changes, ± S.D. and Number of Runs at Indicated Level of Pressure					
		-8	-16	-30	-40	-50	REC
CDR	Preflight	-.014 ±.013 6	-.020 .033 6	-.021 .012 6	-.015 .006 6	-.015 .007 6	-.033 .010 6
CDR	In-flight	-.021 .016 7	-.021 .016 7	-.014 .012 7	-.008 .005 7	-.017 .007 7	-.041 .026 7
CDR	Postflight	-.010 ±.021 8	-.050 .036 8	-.029 .019 8	-.022 .010 8	-.014 .006 8	-.040 .017 8
SPT	Preflight	-.035 ±.042 6	-.031 .011 6	-.044 .007 6	-.038 .010 6	-.026 .010 6	-.079 .019 6
SPT	In-flight	-.028 ±.009 7	-.030 .014 7	-.012 .007 7	-.024 .010 7	-.021 .017 3	-.053 .020 7
SPT	Postflight	-.006 ±.024 8	-.048 .023 8	-.029 .014 8	-.025 .008 8	-.016 .005 5	-.063 .014 8
PLT	Preflight	-.017 ±.009 6	-.025 .013 6	-.032 .018 6	-.027 .011 6	-.018 .006 6	-.039 .014 6
PLT	In-flight	-.047 ±.031 7	-.030 .024 6	-.025 .007 7	-.006 .010 7	-.008 .003 4	-.038 .019 7
PLT	Postflight	-.032 ±.022 8	-.060 .010 8	-.041 .013 8	-.023 .012 8	-.016 .005 8	-.030 .011 8

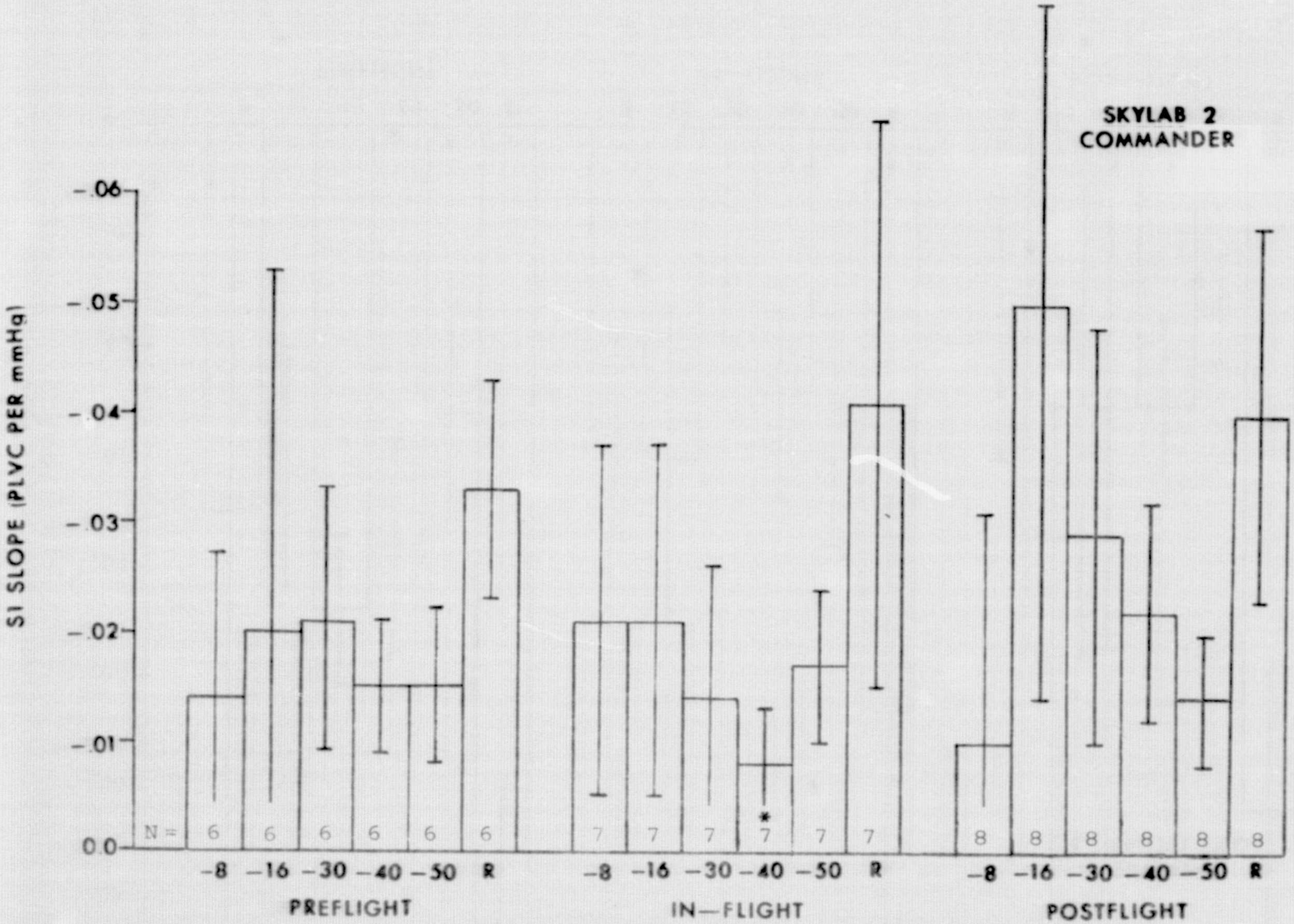

FIGURE 32. HISTOGRAMS SHOWING AVERAGE SI SLOPE COMPLIANCE VALUES ($\pm$ 1 S.D.) FOR ALL LEVELS OF NEGATIVE PRESSURE.
* Indicates a significant difference (P<0.05) from preflight.

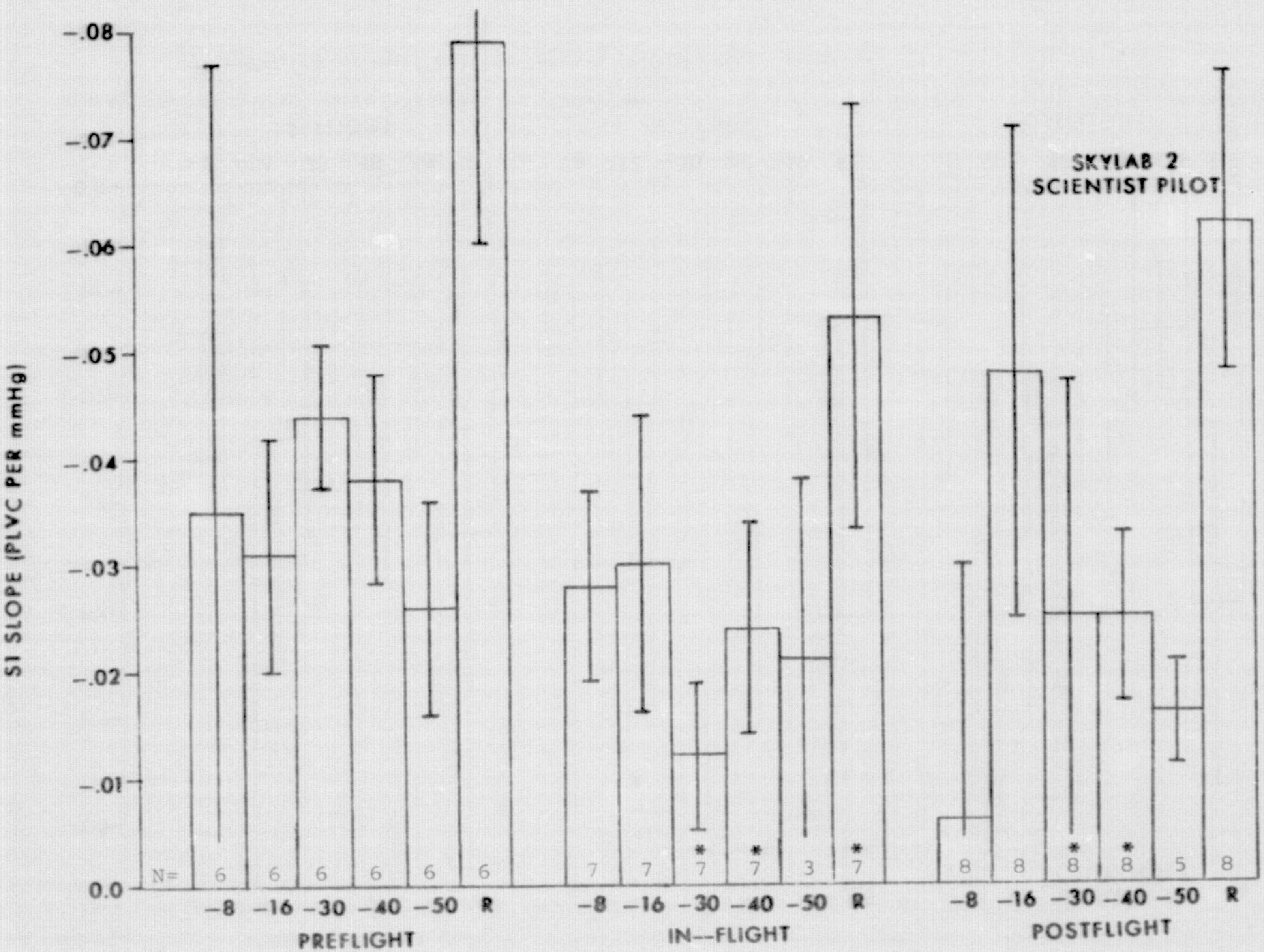

FIGURE 33. HISTOGRAMS SHOWING AVERAGE S1 SLOPE COMPLIANCE VALUES (± 1 S.D.) FOR ALL LEVELS OF NEGATIVE PRESSURE.
* Indicates a significant difference (P<0.05) from preflight.

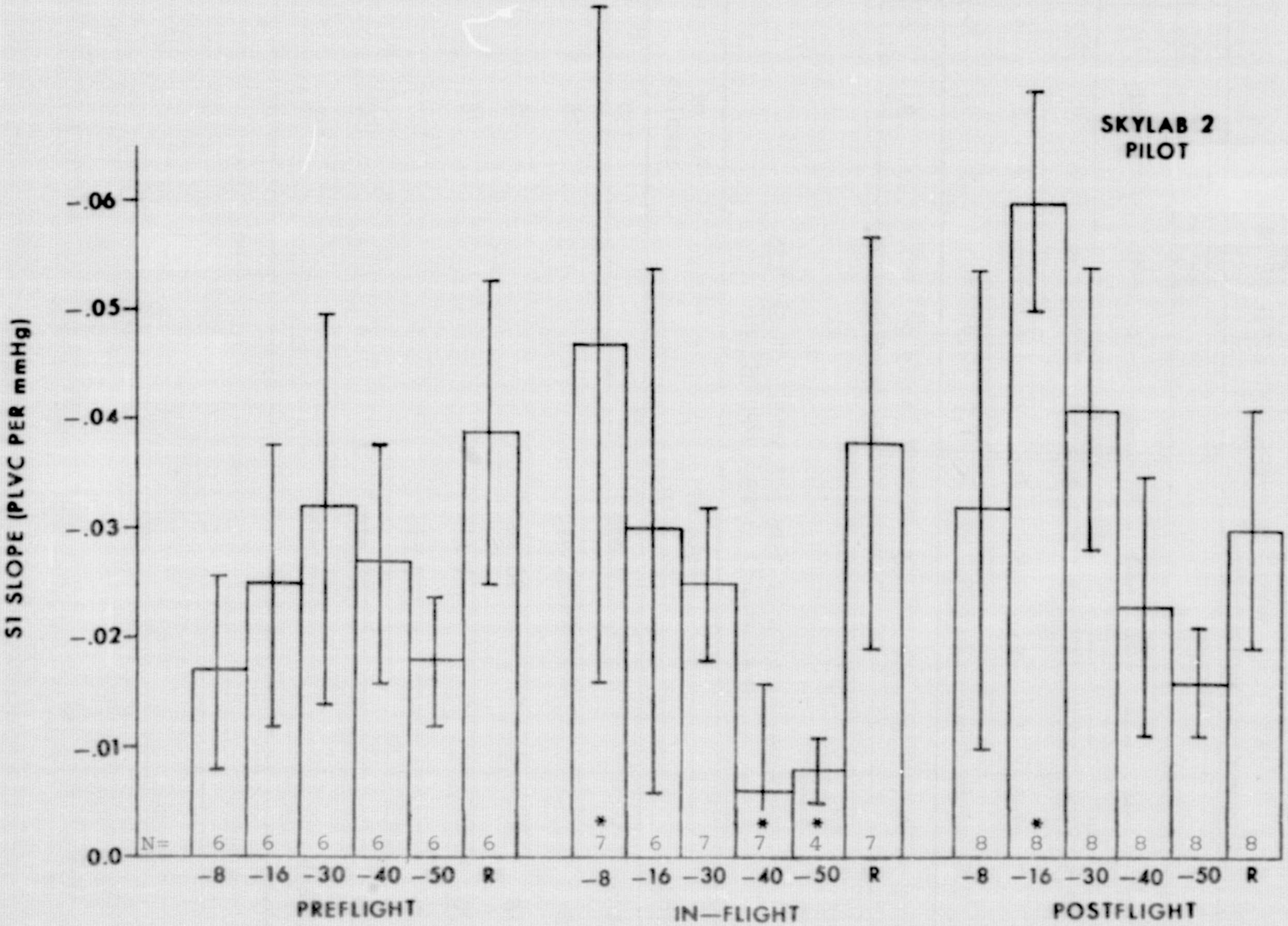

FIGURE 34. HISTOGRAMS SHOWING AVERAGE S1 SLOPE COMPLIANCE VALUES ($\pm$ 1 S.D.) FOR ALL LEVELS OF NEGATIVE PRESSURE.

* Indicates a significant difference ($P<0.05$) from preflight.

TABLE 24. RATIO OF IN-FLIGHT AND POSTFLIGHT S1 COMPLIANCE DATA COMPARED TO THE PREFLIGHT BASELINE DATA.

CREW-MEMBER	IN-FLIGHT						POSTFLIGHT					
	-8	-16	-30	-40	-50	R	-8	-16	-30	-40	-50	R
CDR	1.5	1.1	.7	.5	1.1	1.3	.7	2.5	1.4	1.5	.9	1.2
SPT	.8	1.0	.3	.6	.8	.7	.2	1.6	.6	.7	.6	.8
PLT	2.8	1.2	.8	.2	.4	1.0	1.9	2.4	1.3	.9	.9	.8
GRP MEAN	1.7	1.1	.6	.4	.8	1.0	.9	2.2	1.1	1.0	.8	.9

TABLE 25. LENGTH OF TIME AND NUMBER OF SAMPLES USED FOR S2 SLOPE COMPUTATION.

Period	Length of Time Used	No. of Samples
Control	2 min	150
-8	20 sec	25
-16	20 sec	25
-30	1 min	75
-40	2 min	150
-50	2 min	150
Recovery	2 min	150

TABLE 26. EQUATIONS OF BEST FIT REGRESSION LINE OF PLVC VERSUS TIME FOR THE S2 SLOPE OF CALF VOLUME AT ALL LEVELS OF NEGATIVE PRESSURE (COMMANDER).

RUN	DAY	CODE	CONTROL B0	CONTROL B1	-8 B0	-8 B1	-16 B0	-16 B1	-30 B0	-30 B1	-40 B0	-40 B1	-50 B0	-50 B1	RECOVERY B0	RECOVERY B1
1	357	1	-0.156	0.027	-1.031	0.191	0.564	-0.066	0.589	0.016	0.008	0.093	0.865	0.057	-0.477	0.040
2	25	1	0.471	-0.073	-1.101	0.185	0.020	0.079	1.834	-0.047	0.856	0.110	1.910	0.088	3.191	-0.117
3	61	1	0.064	-0.012	-0.108	0.054	0.647	-0.124	0.666	0.077	1.185	0.087	1.115	0.084	-0.087	-0.012
4	78	1	0.516	-0.096	0.355	-0.043	1.495	-0.135	2.004	-0.055	-0.347	0.191	0.858	0.138	3.372	-0.099
5	106	1	-0.039	-0.010	0.803	-0.075	0.747	0.010	1.011	0.057	1.256	0.060	0.568	0.118	1.201	-0.013
6	131	1	0.431	-0.042	0.788	-0.108	-6.606	1.102	1.537	-0.046	0.881	0.071	1.187	0.073	1.059	-0.054
7	149	2	-0.466	0.041	-7.230	1.411	-0.623	0.488	2.997	0.094	2.957	0.148	3.158	0.186	2.209	-0.085
8	153	2	-0.138	0.020	-2.814	0.720	2.563	-0.007	1.927	0.109	3.512	0.119	4.618	0.099	4.239	-0.142
9	156	2	0.166	-0.046	-3.029	0.704	-3.199	0.762	1.877	0.159	2.951	0.071	2.846	0.111	1.690	-0.067
10	160	2	0.013	-0.001	-9.332	1.764	3.427	-0.261	1.514	0.110	1.491	0.135	2.564	0.105	1.973	-0.081
11	163	2	0.036	-0.007	-1.558	0.479	-1.273	0.501	1.602	0.163	2.763	0.088	2.289	0.143	1.106	0.000
12	166	2	-0.005	0.008	-5.323	1.101	-1.188	0.490	2.894	-0.004	2.754	0.063	2.185	0.138	2.275	-0.057
13	169	2	0.511	-0.103	-4.085	0.867	-5.039	1.039	-1.550	0.579	2.471	0.142	2.662	0.170	3.595	-0.093
14	173	3	-0.037	0.017	0.440	-0.065	-0.343	0.164	0.893	0.101	1.153	0.108	0.849	0.151	1.604	-0.018
15	174	3	-0.106	0.016	-0.973	0.175	1.136	-0.072	0.954	0.078	1.262	0.091	1.563	0.092	0.665	0.005
16	175	3	0.403	-0.053	0.287	-0.015	1.706	-0.053	2.757	0.062	3.431	0.058	3.363	0.090	2.669	-0.110
17	177	3	0.617	-0.098	2.740	-0.348	0.355	0.152	0.976	0.120	1.354	0.122	1.665	0.131	0.351	0.048
18	181	3	0.170	-0.021	0.219	0.012	1.751	-0.145	1.263	-0.007	0.775	0.083	-0.262	0.168	1.283	-0.034
19	187	3	0.451	-0.067	1.240	-0.170	1.738	-0.120	1.465	0.045	2.132	0.012	2.562	0.018	0.460	0.004
20	193	3	0.399	-0.078	-0.168	0.124	0.475	0.157	1.746	0.075	0.985	0.194	1.969	0.167	3.726	-0.066
21	236	3	0.126	-0.024	1.201	-0.199	0.785	-0.073	0.766	0.042	0.893	0.041	0.628	0.073	0.966	-0.044

TABLE 27. EQUATIONS OF BEST FIT REGRESSION LINE OF PLVC VERSUS TIME FOR THE S2 SLOPE OF CALF VOLUME AT ALL LEVELS OF NEGATIVE PRESSURE (SCIENTIST PILOT).

RUN	DAY	CODE	CONTROL B0	CONTROL B1	-8 B0	-8 B1	-16 B0	-16 B1	-30 B0	-30 B1	-40 B0	-40 B1	-50 B0	-50 B1	RECOVERY B0	RECOVERY B1
1	357	1	-0.001	-0.003	-0.328	0.129	-2.476	0.586	1.646	0.126	3.989	-0.047	4.734	-0.042	4.713	-0.190
2	26	1	0.800	-0.140	0.601	-0.063	-0.180	0.119	1.161	0.192	3.499	0.047	4.125	0.048	2.145	-0.062
3	57	1	0.424	-0.034	-0.069	0.064	-0.546	0.130	2.015	0.078	3.069	0.088	4.722	0.024	1.828	-0.058
4	78	1	0.040	0.003	-0.230	0.060	0.509	0.010	1.451	0.197	4.300	0.035	4.854	0.064	2.341	-0.076
5	106	1	0.301	-0.059	2.039	-0.331	-1.480	0.381	2.557	0.083	4.175	0.031	4.028	0.079	1.196	-0.035
6	131	1	1.495	-0.332	2.357	-0.342	5.681	-0.685	2.204	0.083	4.257	-0.008	4.555	0.022	-0.204	-0.045
7	149	2	-0.351	0.063	2.964	-0.325	1.599	0.048	2.101	0.087	0.621	0.205	3.346	0.045	0.188	0.026
8	154	2	1.691	-0.328	-3.330	0.913	-2.595	0.914	-2.754	0.658	4.773	0.183	5.208	0.184	4.355	-0.073
9	157	2	-0.333	0.067	-1.483	0.325	-5.465	1.026	6.762	0.257	4.457	0.001	2.341	0.177	2.147	-0.059
10	161	2	0.076	-0.017	0.508	0.038	-0.686	0.377	1.719	0.207	3.113	0.135	3.526	0.107	1.670	-0.048
11	164	2	-0.090	0.027	-0.507	0.202	3.072	-0.178	1.555	0.231	3.119	0.187	3.575	0.117	2.488	-0.095
12	167	2	0.406	-0.036	0.328	0.048	-2.419	0.591	0.756	0.298	3.067	0.145	5.737	-0.005	3.427	-0.131
13	169	2	0.475	-0.055	1.362	[illegible]	-4.387	1.042	1.800	0.319	4.839	0.093	5.096	0.078	1.800	-0.065
14	173	3	0.318	-0.050	2.634	-0.429	2.775	-0.297	1.052	0.144	1.003	0.209	*******	*******	-0.875	0.070
15	174	3	0.051	0.007	1.119	-0.102	-3.438	0.649	1.178	0.112	2.112	0.066	2.755	0.030	2.668	-0.076
16	175	3	0.354	-0.058	1.248	-0.199	2.410	-0.237	1.791	0.098	2.593	0.099	3.251	0.058	1.856	-0.057
17	178	3	0.049	-0.004	1.080	-0.201	0.546	0.105	1.976	0.095	2.367	0.116	2.768	0.117	3.536	-0.095
18	181	3	0.278	-0.074	-1.638	0.290	-0.487	0.256	2.228	0.087	3.218	0.044	3.227	0.074	2.085	-0.056
19	187	3	0.155	-0.009	0.000	0.059	0.824	0.136	2.895	0.068	3.976	0.082	2.880	0.144	-1.142	0.083
20	197	3	0.380	-0.067	-0.440	0.145	0.859	0.092	2.481	0.096	3.862	0.043	3.745	0.091	2.453	-0.084
21	236	3	-0.048	0.009	0.692	-0.085	1.009	-0.085	1.368	-0.000	1.405	0.066	1.713	0.061	-0.045	0.027

TABLE 28. EQUATIONS OF BEST FIT REGRESSION LINE OF PLVC VERSUS TIME FOR THE S2 SLOPE OF CALF VOLUME AT ALL LEVELS OF NEGATIVE PRESSURE (PILOT)

RUN	DAY	CODE	CONTROL B0	CONTROL B1	-8 B0	-8 B1	-16 B0	-16 B1	-30 B0	-30 B1	-40 B0	-40 B1	-50 B0	-50 B1	RECOVERY B0	RECOVERY B1
1	357	1	-0.331	0.072	-0.037	0.024	0.770	-0.001	1.196	0.060	1.484	0.079	1.356	0.113	0.595	0.025
2	30	1	-0.489	0.062	-2.812	0.540	0.134	0.061	0.667	0.013	0.622	0.076	1.488	0.051	1.473	-0.025
3	57	1	0.289	-0.062	-1.310	0.265	-0.893	0.228	0.742	0.143	1.149	0.129	2.037	0.099	1.802	-0.015
4	78	1	0.313	-0.056	0.440	-0.077	0.036	0.018	0.145	0.095	0.453	0.088	0.202	0.115	1.690	-0.038
5	106	1	0.085	-0.020	-1.233	0.249	0.190	0.072	0.704	0.098	1.473	0.062	1.416	0.095	0.638	0.004
6	131	1	0.054	-0.010	-0.767	0.148	-0.343	0.132	0.713	0.109	0.493	0.162	1.654	0.117	2.283	-0.040
7	148	2	0.010	-0.003	-0.937	0.425	2.670	0.013	2.861	0.128	3.502	0.084	4.102	0.087	3.400	-0.100
8	151	2	-0.335	0.084	-6.009	1.232	1.628	0.069	2.071	0.122	2.984	0.072	2.458	0.130	1.832	-0.042
9	155	2	-0.192	0.017	4.162	-0.553	3.903	-0.260	8.490	0.153	3.389	0.112	3.888	0.110	2.593	-0.084
10	159	2	0.135	-0.015	-1.274	0.421	-4.839	0.979	1.123	0.230	2.982	0.089	2.725	0.129	1.987	-0.054
12	165	2	0.609	0.002	-1.538	0.793	-0.003	0.669	5.202	0.061	*******	*******	6.665	0.000	2.309	-0.039
13	168	2	-0.417	0.041	-0.117	1.012	4.187	-0.158	8.734	0.185	3.840	0.135	4.181	0.113	-0.123	0.087
14	171	2	0.400	-0.028	-0.659	0.408	0.888	0.244	-0.037	0.505	4.367	0.118	4.400	0.113	1.735	-0.009
15	173	3	0.030	-0.001	-1.554	0.298	-1.187	0.258	0.485	0.086	0.925	0.072	1.074	0.082	1.875	-0.037
16	174	3	0.098	-0.023	2.019	-0.312	-0.827	0.314	1.220	0.115	1.698	0.105	1.660	0.125	2.747	-0.056
17	175	3	0.136	-0.007	0.211	-0.003	0.492	0.085	1.482	0.136	0.569	0.284	2.695	0.177	2.134	0.010
18	178	3	-0.612	0.019	-0.233	0.100	1.088	-0.007	1.423	0.170	2.407	0.112	2.777	0.114	2.997	-0.027
19	181	3	0.406	-0.060	0.279	0.015	-0.539	0.283	2.415	0.043	2.005	0.111	2.135	0.130	2.150	-0.031
20	186	3	0.347	-0.066	1.327	-0.174	1.419	-0.041	1.955	0.025	1.870	0.085	1.682	0.118	4.640	-0.138
21	194	3	0.337	-0.062	0.987	-0.113	0.533	0.040	1.988	0.076	2.261	0.102	2.672	0.108	0.855	0.017
22	236	3	0.431	-0.037	-0.111	0.061	-0.887	0.236	2.252	-0.002	2.280	0.038	1.966	0.075	1.083	-0.022

TABLE 29. SUMMARY OF S2 SLOPE CHANGES (PLVC/MINUTE) INDUCED BY LOWER BODY NEGATIVE PRESSURE.

SUBJECT	EXPR CODE	Average S2 Slope Value, ±S. D. and Number of Runs at Indicated Level of Pressure						
		CONTROL	-8	-16	-30	-40	-50	R
CDR	Preflight	-.03 ±.05 6	.03 .13 6	.14 .48 6	.01 .05 6	.10 .05 6	.09 .03 6	-.04 .06 6
CDR	In-flight	-.01 ±.05 7	1.01 .45 7	.43 .44 7	.17 .19 7	.11 .04 7	.14 .03 7	-.06 .05 7
CDR	Postflight	-.04 ±.04 8	-.06 -.17 8	.00 .13 8	.06 .04 8	.09 .06 8	.11 .05 8	-.03 .05 8
SPT	Preflight	-.09 ±.13 6	-.09 .20 6	.09 .43 6	.13 .06 6	.02 .05 6	.03 .04 6	-.08 .06 6
SPT	In-flight	-.05 ±.14 7	.18 .38 7	.55 .49 7	.29 .18 7	.13 .07 7	.10 .07 7	-.06 .05 7
SPT	Postflight	-.03 ±.04 8	-.08 .23 8	.08 .30 8	.09 .04 8	.08 .06 8	.08 .04 7	-.02 .07 8
PLT	Preflight	.00 ±.06 6	.19 .22 6	.09 .08 6	.08 .04 6	.10 .04 6	.10 .02 6	-.01 .03 6
PLT	In-flight	.01 ±.04 7	.55 .58 7	.22 .45 7	.20 .15 7	.10 .02 6	.10 .05 7	-.04 .05 7
PLT	Postflight	-.03 ±.03 8	-.02 .19 8	.15 .14 8	.08 .06 8	.11 .08 8	.12 .03 8	-.04 .05 8

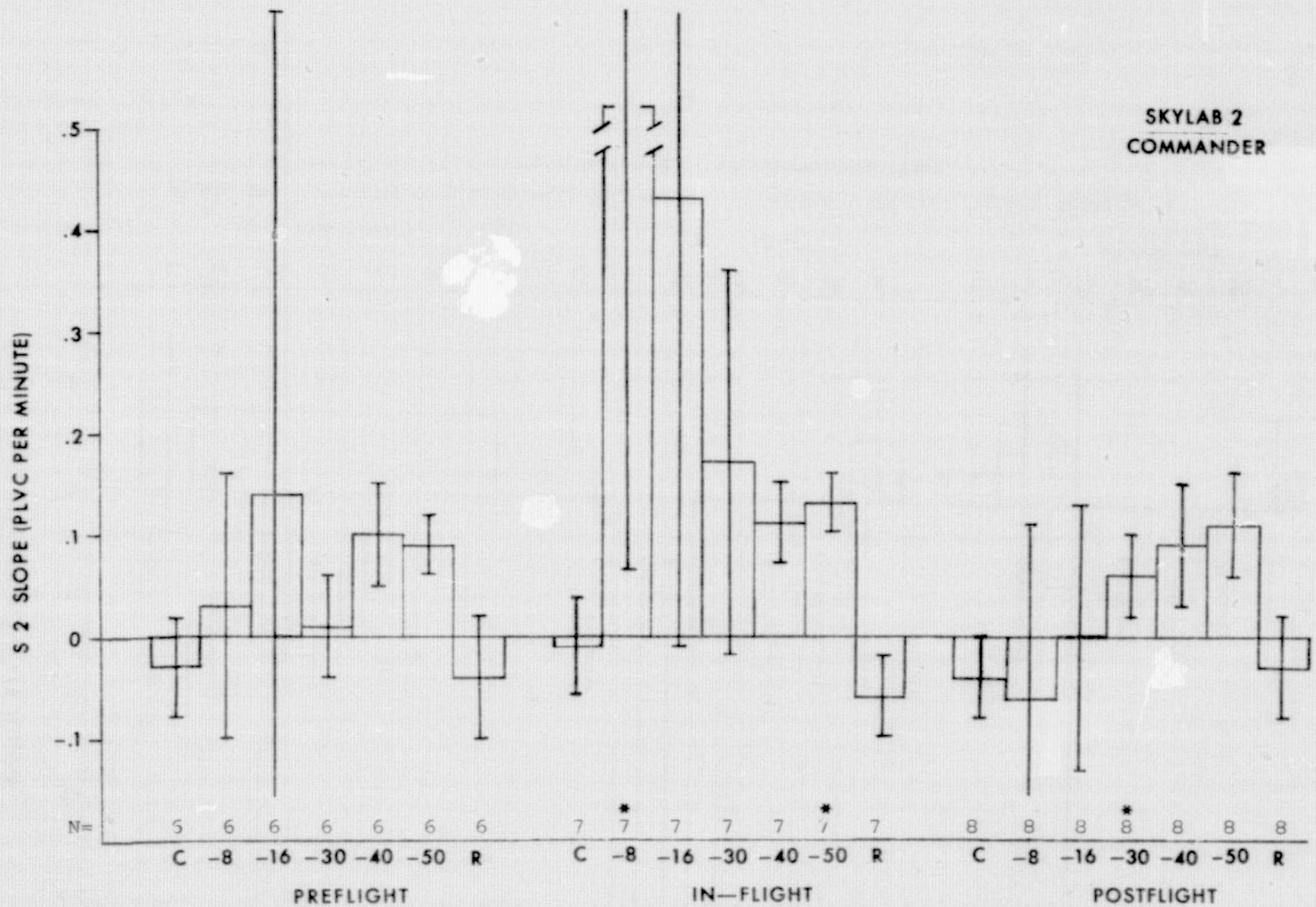

FIGURE 35. HISTOGRAMS SHOWING AVERAGE S2 SLOPE VALUES ($\pm$1 S.D.) FOR ALL LEVELS OF NEGATIVE PRESSURE.

* Indicates a significant difference ($P<0.05$) from preflight.

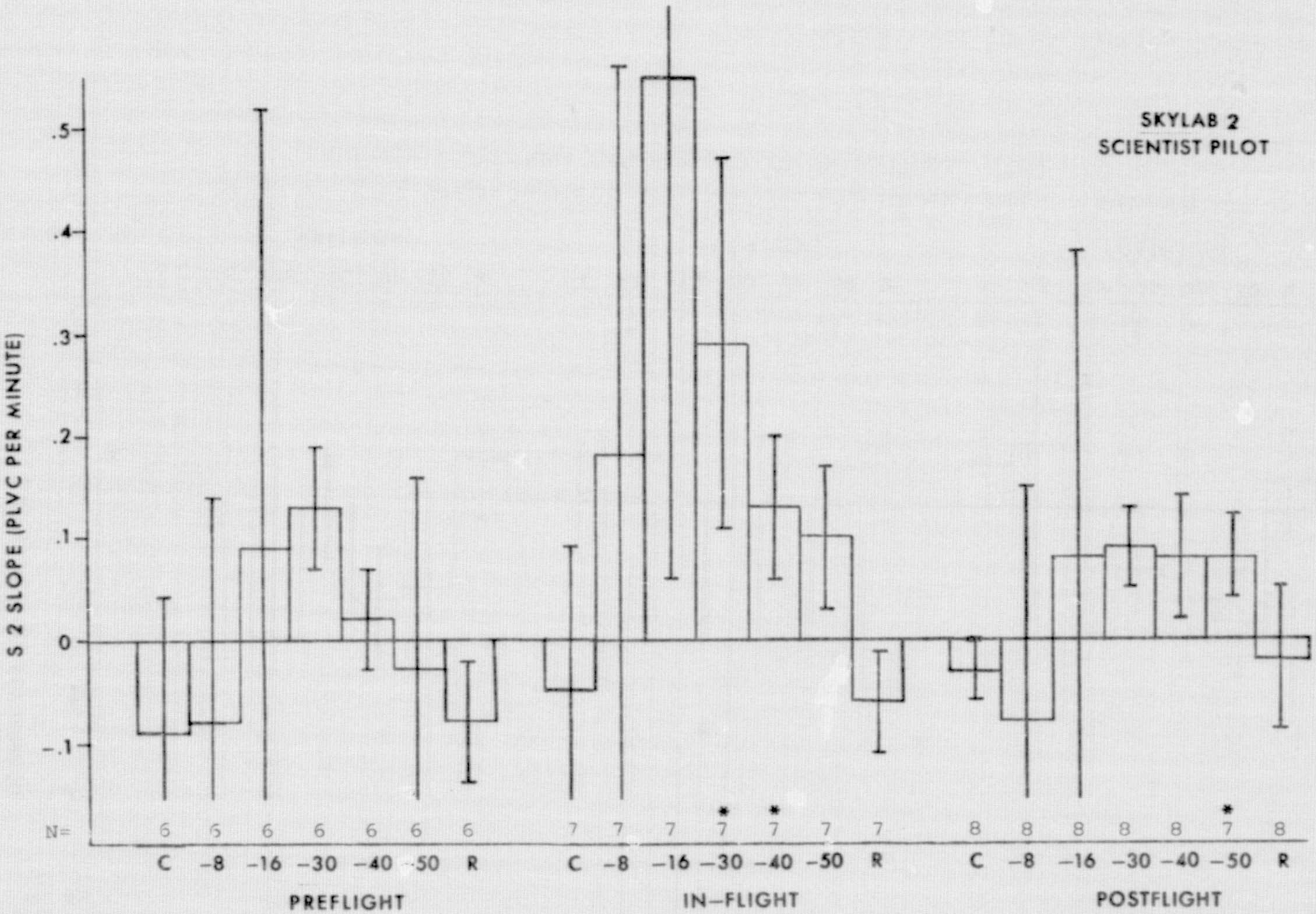

FIGURE 36. HISTOGRAMS SHOWING AVERAGE S2 SLOPE VALUES (± 1 S.D.) FOR ALL LEVELS OF NEGATIVE PRESSURE

* Indicates a significant difference ($P<0.05$) from preflight.

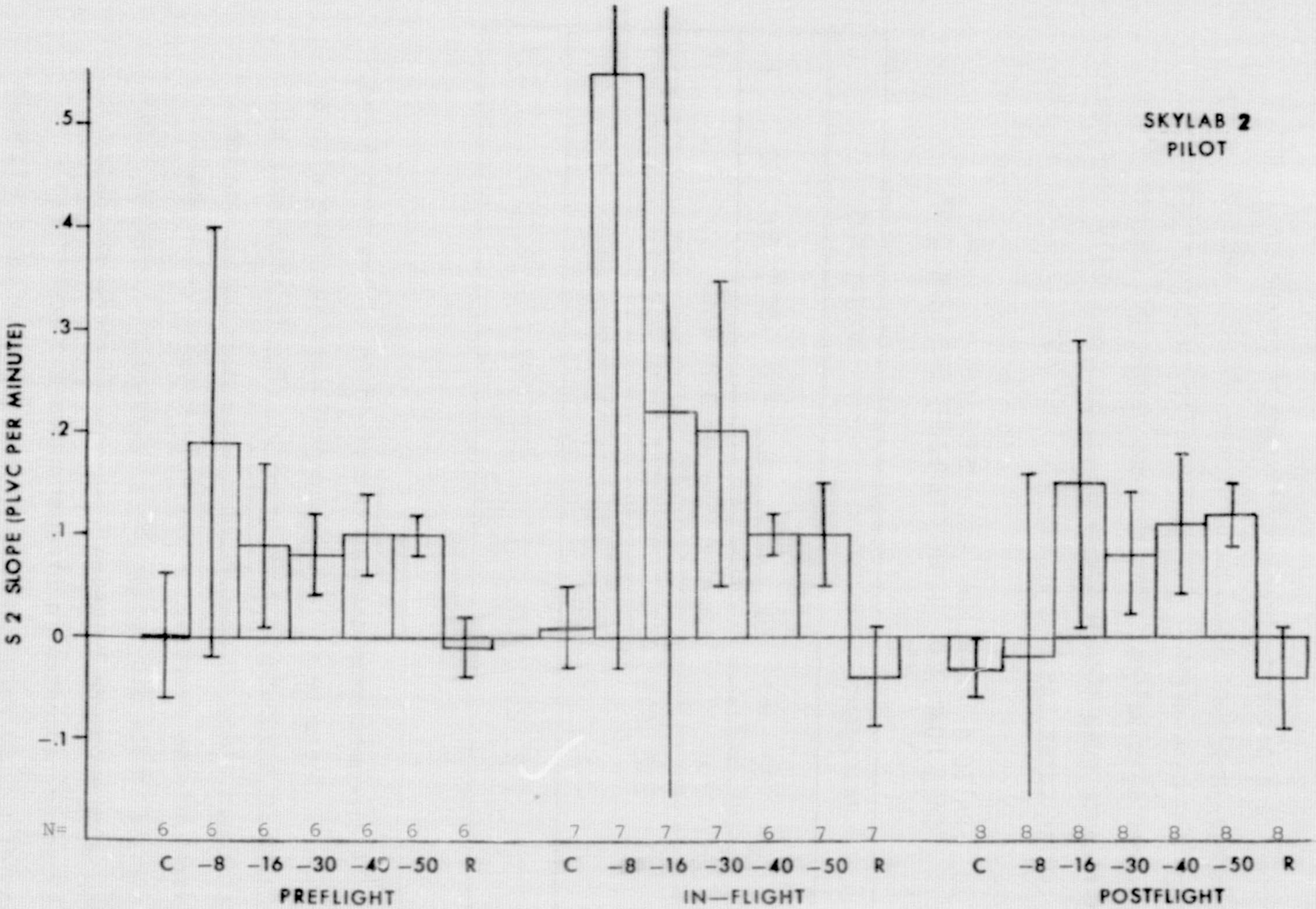

FIGURE 37. HISTOGRAMS SHOWING AVERAGE S2 SLOPE VALUES ($\pm$1 S.D.) FOR ALL LEVELS OF NEGATIVE PRESSURE
* Indicates a significant difference (P<0.05) from preflight.

S2 slopes demonstrate a pattern clearly different from the preflight values. The average in-flight S2 slopes for the -8, -16 and -30 mm Hg negative pressure are considerably, though usually not significantly, higher than the preflight values. The extreme variations between runs precludes significance even though the mean values are widely different. Table 30 clearly indicates the higher average in-flight S2 slope values.

TABLE 30. RATIO OF IN-FLIGHT AND POSTFLIGHT S2 SLOPE DATA COMPARED TO THE PREFLIGHT BASELINE DATA.

Crew-member	IN-FLIGHT						POSTFLIGHT					
	-8	-16	-30	-40	-50	R	-8	-16	-30	-40	-50	R
CDR	33.7	3.1	17.0	1.1	1.4	1.5	-2.0	0.0	6.0	.9	1.2	.8
SPT	3.3	6.1	2.2	6.5	4.3	.8	1.0	.9	.7	4.0	-2.7	.3
PLT	2.9	2.4	2.5	1.0	1.0	4.0	- .1	1.7	1.0	1.1	1.2	4.0
Group Mean	13.3	3.9	7.2	2.9	2.2	2.1	- .37	.87	2.6	2.0	- .1	1.7

Calf Circumference.

The left calf circumference data as tabulated in Tables 3 to 5 and graphed in Figure 38 indicate a fluctuating preflight baseline with an immediate decrease on exposure to zero gravity. The initial rate of decrease is not known since no measurements were made until mission day 5. The extent of the decrease is variable between crewmembers; however, the circumference did appear to be stabilized somewhat after the initial 5-6 days exposure to weightlessness. Postflight data demonstrated sizeable increases in circumference and considerable variation in an effort to return slowly to preflight values. Although the transitional nature of the change in calf circumference during the initial weightlessness would complicate the analysis, the Skylab 2

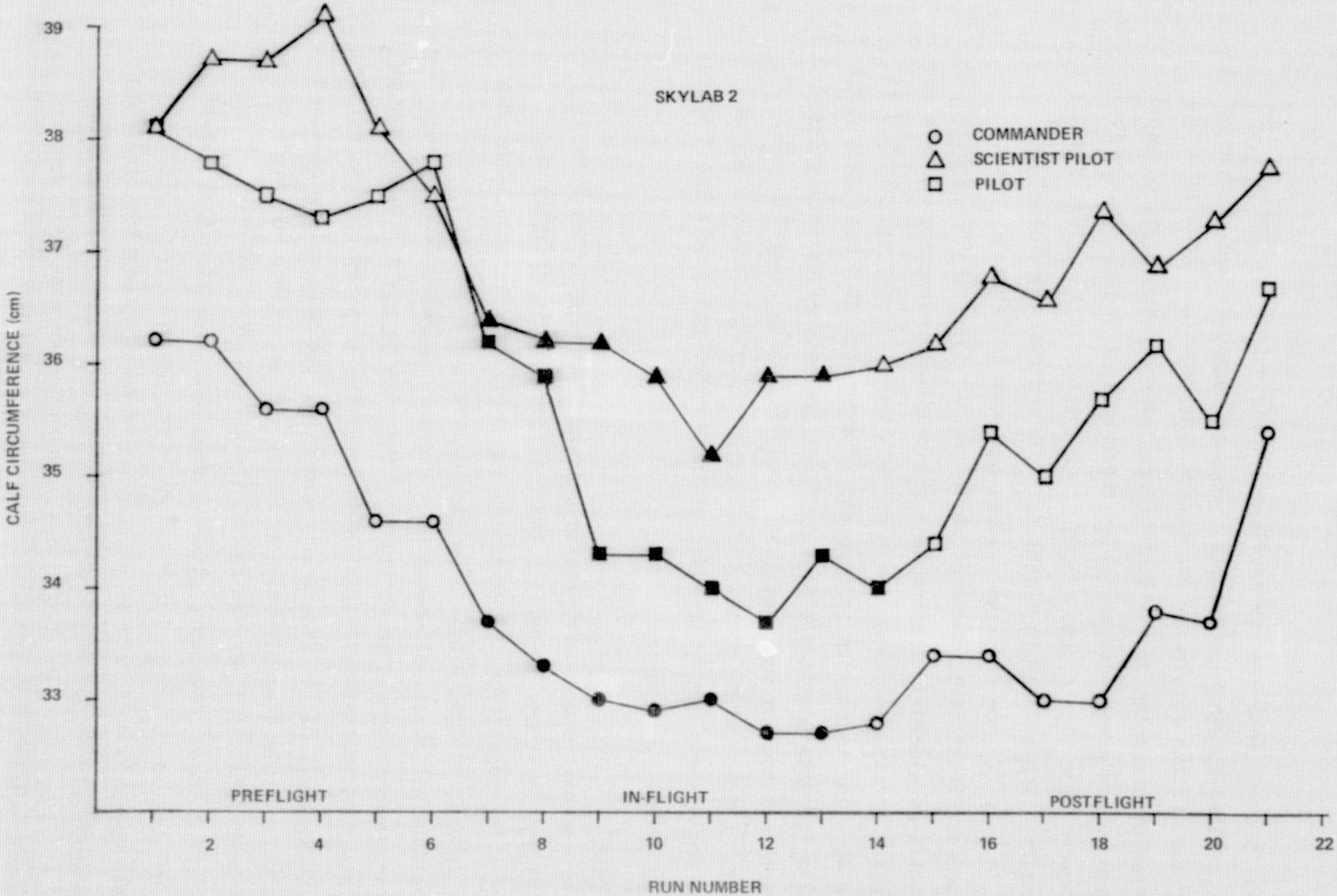

FIGURE 38. GRAPH OF LEFT CALF CIRCUMFERENCE FOR EACH ASTRONAUT FOR ALL MISSION PHASES.

data was grouped into average preflight, in-flight and postflight categories similar to other parameters. This average data was graphed as histograms and the results of the t-test indicated in Figure 39. Even this type of averaging of in-flight circumference which would increase the mean circumference did not alter the fact that the in-flight circumferences were significantly lower than the preflight values for all astronauts. The average in-flight calf circumference decreased by approximately 7% from preflight values as shown in Table 31. The average postflight circumferences while greater than the in-flight values were still considerably smaller than the preflight averages. Graphs and regression of the calf circumferences versus mission day are plotted in Figure 40. The regression is computed on the basis of linear data which is valid for data obtained after the first few days of weightlessness but certainly not for data obtained immediately after entering zero gravity. Extrapolation of the data beyond the actual data collection period would yield highly speculative information based on a small number of data points.

Body Mass

The changes in the body mass data as tabulated in Tables 3 to 5 and graphed in Figure 41 reflect the combined effects of short term zero gravity adaptation, elevated environmental temperatures, diet and other experiment conditions. The varying preflight body mass was followed in all three astronauts by a dramatic decrease in mass upon entering weightlessness or at least by the time of the first measurement. Subsequent to the initial fluid shift resulting in an average mass loss of approximately 5% for the three crewmembers the mass values remained reasonably stable with slightly declining values. Since no mass measurements were made until mission day 5, the exact nature and rate of mass loss is not known. However, other studies have indicated that a rapid loss of mass would surely occur in the first several days. Since this rapidly changing mass data is not available for this mission, the data was grouped by average preflight, in-flight and postflight phases as shown in Figure 42. The t-test analysis indicated that the average

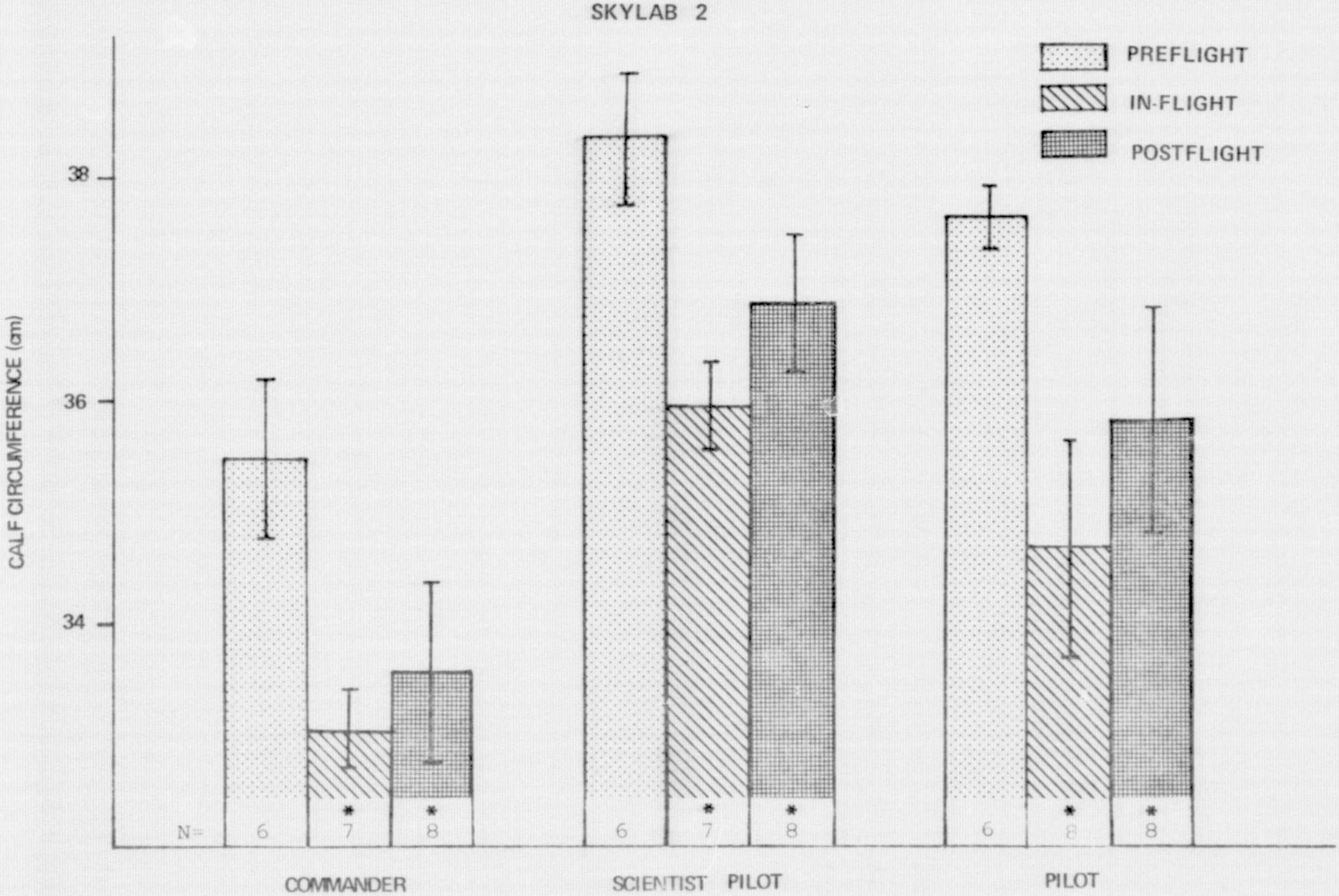

FIGURE 39. HISTOGRAMS OF AVERAGE LEFT CALF CIRCUMFERENCE ($\pm$1 S.D.) FOR ALL ASTRONAUTS FOR ALL MISSION PHASES.

* Indicates a significant difference ($P<0.05$) from preflight

TABLE 31. AVERAGE LEFT CALF CIRCUMFERENCE BY MISSION PHASE AND COMPARISON WITH PREFLIGHT VALUES.

SUBJECT	EXPR CODE	AVER LEFT CALF CIRCUM (cm)	S.D.	N	% DECREASE FROM PREFLIGHT
CDR	Preflight	35.47	.72	6	---
CDR	In-flight	33.04	.36	7	6.8
CDR	Postflight	33.56	.82	3	5.4
SPT	Preflight	38.37	.58	6	---
SPT	In-flight	35.96	.39	7	6.3
SPT	Postflight	36.88	.61	8	3.9
PLT	Preflight	37.67	.29	6	---
PLT	In-flight	34.67	.97	8	8.0
PLT	Postflight	35.84	1.06	8	4.9

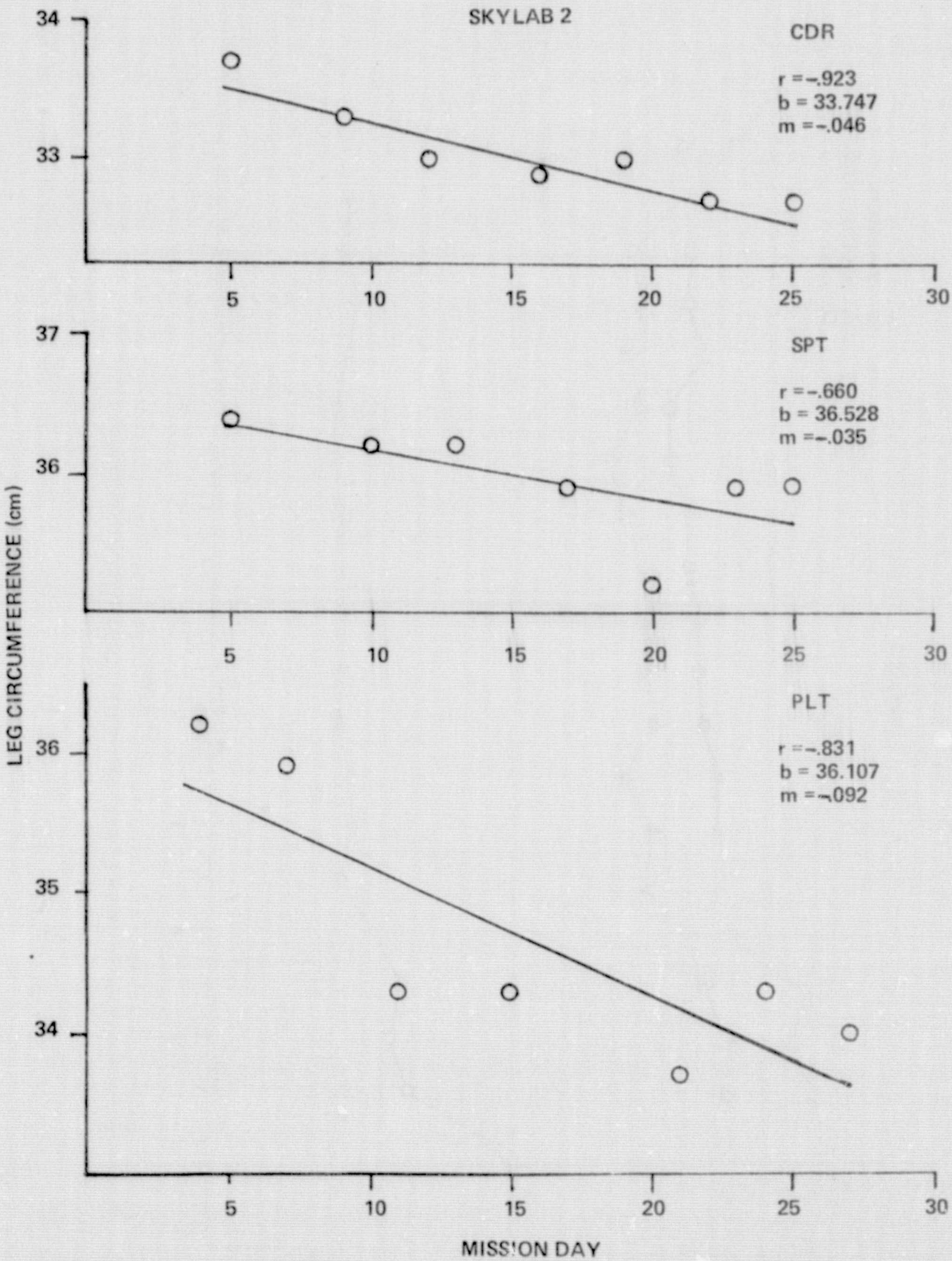

FIGURE 40. GRAPH AND REGRESSION OF IN-FLIGHT LEFT CALF CIRCUMFERENCE VERSUS MISSION DAY.

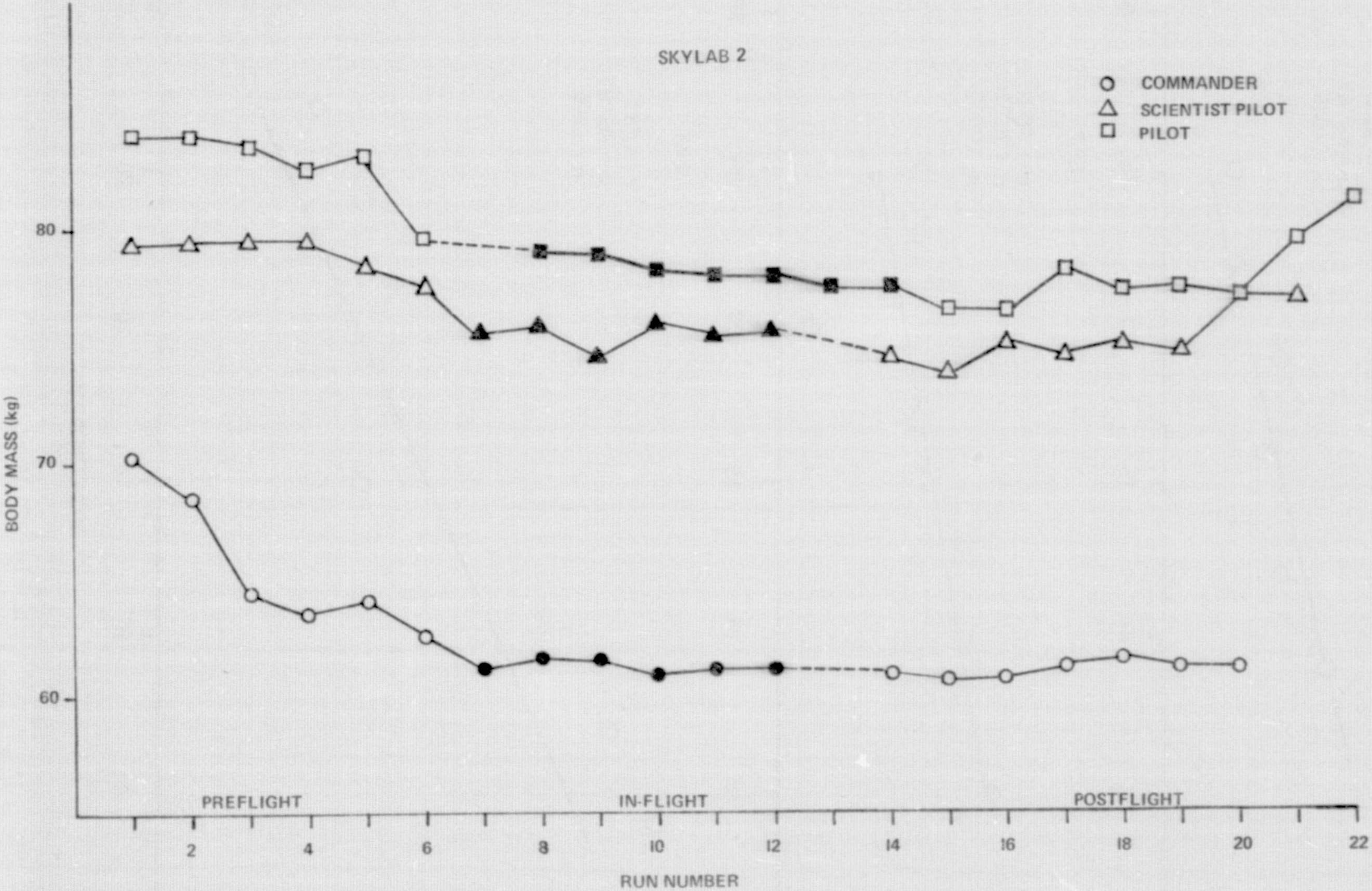

FIGURE 41. GRAPH OF BODY MASS FOR EACH ASTRONAUT FOR EACH MISSION PHASE.

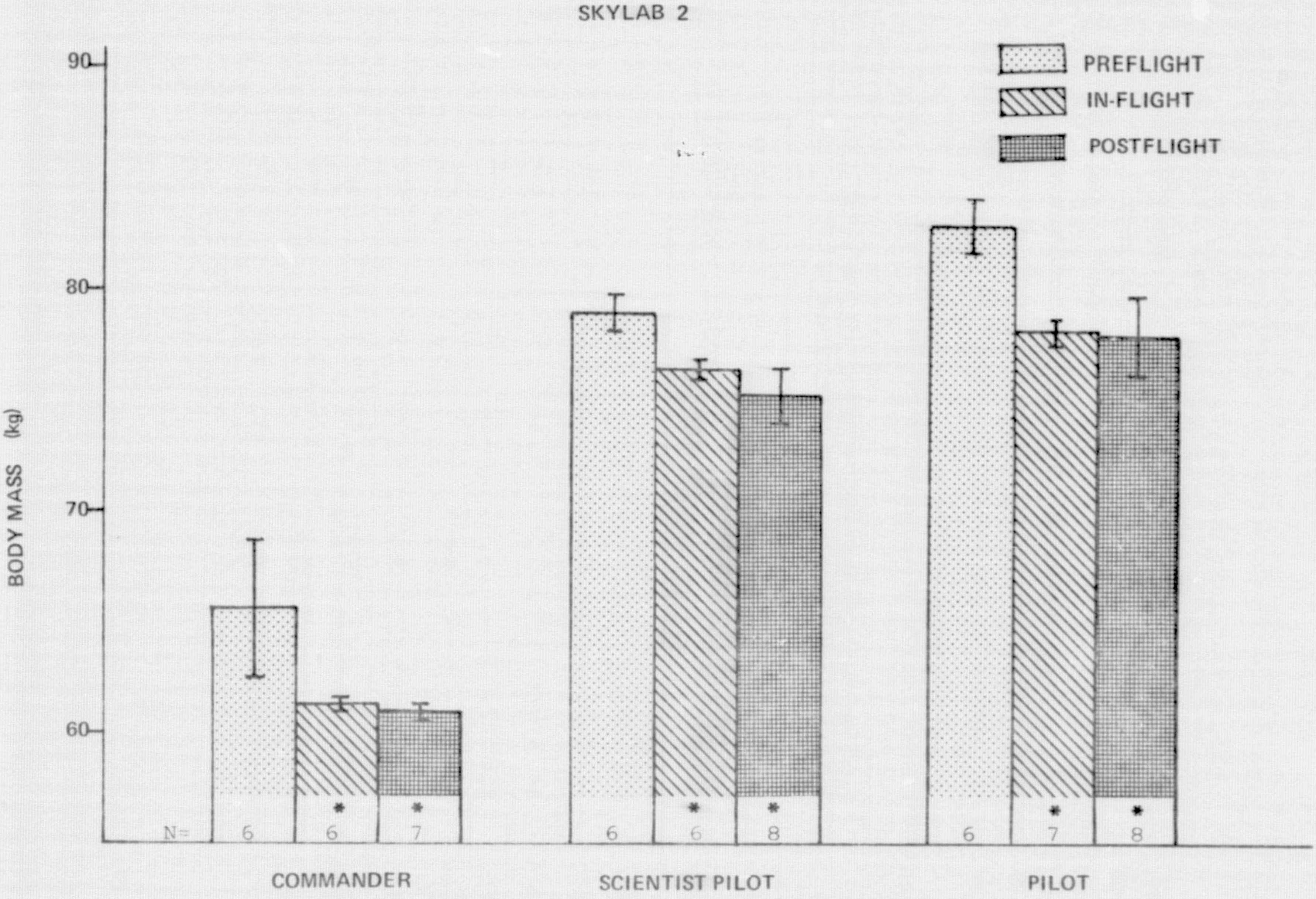

FIGURE 42. HISTOGRAMS OF AVERAGE BODY MASS ($\pm$1 S.D.) FOR ALL ASTRONAUTS FOR ALL MISSION PHASES.

* Indicates a significant difference ($P<0.05$) from preflight

in-flight body mass was significantly lower than the average preflight values for all crewmembers. Although the postflight data demonstrated an increasing trend, it was not dramatic and remained considerably below preflight levels. The average body mass values and the comparison to preflight data is contained in Table 32. The graph and regression of body mass versus mission day shown in Figure 43 indicate the nature of the body mass changes for the duration of exposure to zero gravity. The slope of the change was not dramatic for any of the crewmen although the pilot did sustain a loss of almost 0.1 Kg per day.

TABLE 32. AVERAGE BODY MASS VALUES BY MISSION PHASE AND COMPARISON WITH PREFLIGHT VALUES.

SUBJECT	EXPR CODE	AVERAGE BODY MASS (Kg)	S.D.	N	% DECREASE FROM PREFLIGHT
CDR	Preflight	65.6	3.1	6	---
CDR	In-flight	61.4	.3	6	6.4
CDR	Postflight	61.0	.4	7	7.0
SPT	Preflight	78.9	.8	6	---
SPT	In-flight	75.5	.5	6	4.3
SPT	Postflight	75.3	1.2	8	4.6
PLT	Preflight	83.0	1.2	6	---
PLT	In-flight	78.2	.6	6	5.7
PLT	Postflight	78.0	1.7	8	6.0

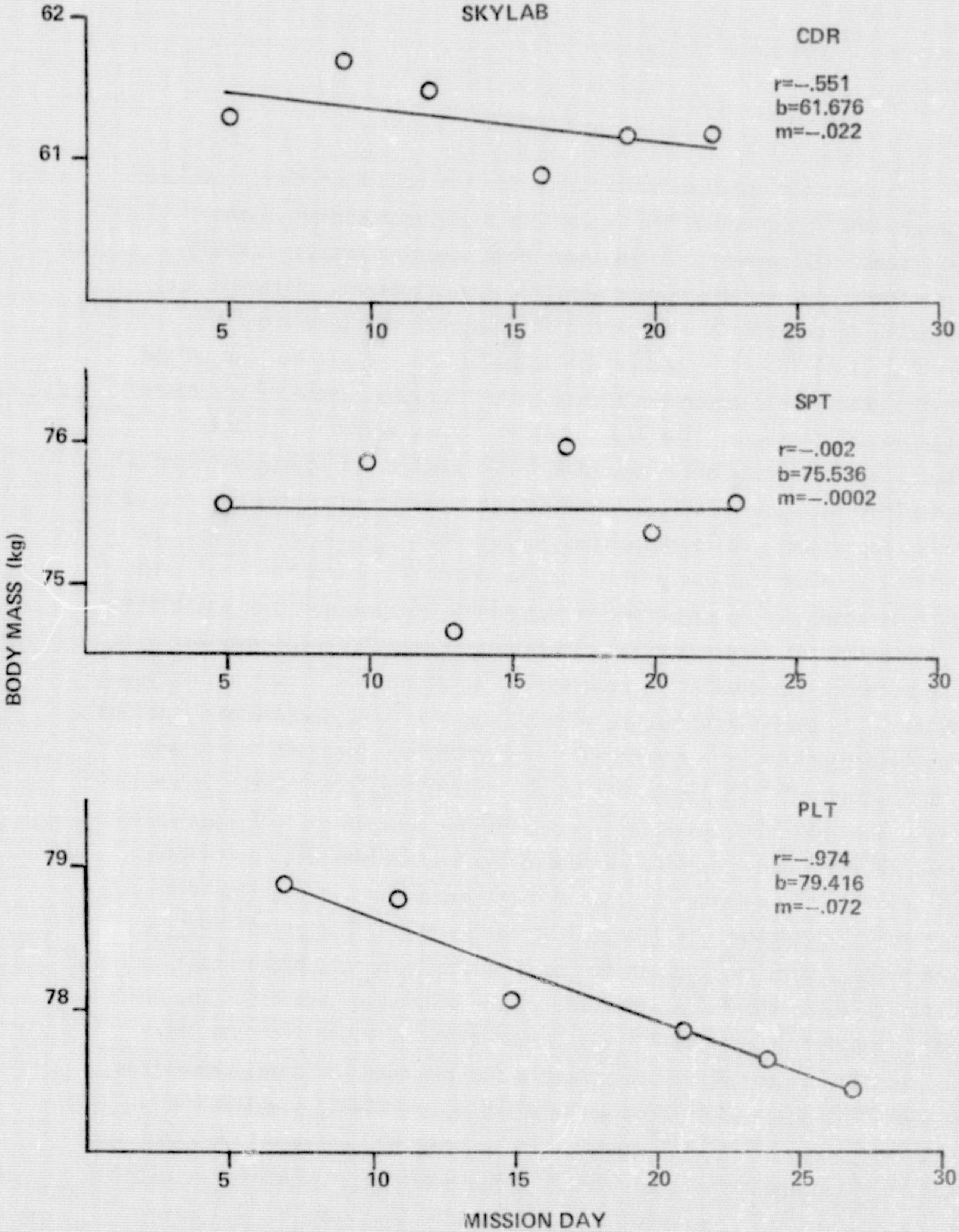

FIGURE 43. GRAPH AND REGRESSION OF IN-FLIGHT LEFT CALF CIRCUMFERENCE VERSUS MISSION DAY.

DISCUSSION

The full and complete explanation for the nature of the leg volume changes that occurred on the Skylab 2 mission in response to the weightless environment and the lower body negative pressure (M092) experiment will require more scientific investigation. Although much valuable information and understanding has been obtained about the physiological responses and capabilities of man in this new and unique environment, these experiments only begin to explain some of his basic adaptations to space. The leg volume responses described in this report are obviously only part of a large spectrum of neurophysiological, musculoskeletal, biochemical and cardiovascular adjustments required for this adaptation. While the discussion of leg volume responses will be related to other cardiovascular changes where possible, the final cross-correlational and inter-parameter relationships have not been established.

Significant cardiovascular alterations appear to occur very early in the zero gravity adaptation process. A major portion of the 5% average decrease in calf circumference recorded on the first measurement (mission day 5) probably occurred much earlier (within the first 48 hours) and represented a 1 to 2 liter loss in fluid from the legs. Earth laboratory tests indicate that the fluid shift from the legs of an individual placed in a 15^{o} head down position is substantially complete within the first 24 hours. This massive vascular and extravascular fluid shift, although not well quantitated for time course on the Skylab 2 mission, must be the primary forcing function for many of the hormonal, biochemical and cardiovascular phenomena important to the adaptation process. The head-ward transfer of this relatively large volume of fluid from the lower extremities is apparently responsible for the head and nasal congestion and distention of upper body veins which occurs almost simultaneously with the onset of weightlessness. These symptoms continue throughout the flight phase and abruptly disappear a few hours after the reentry with occurrence of the reverse shift of fluid into the lower extremities.

C-2

In the classical sense, the increased thoracic fluid should be sensed as an expanded blood volume and initiate the appropriate neurohormonal reflexes for restoration of fluid balance. Concomitantly the increased venous return must transiently affect cardiac parameters and the baroceptors resulting in reflex alterations in cardiovascular dynamics. Many of the compensatory mechanisms must have resulted in transient alterations which were complete before lower body negative pressure testing was initiated. By mission day 5, the fluid shift had precipitated some reduction in total circulation blood volume, some hemoconcentration (11) and somewhat more empty veins of the lower extremities.

The LBNP device was designed to be a well-controlled stress device useful in both zero and earth gravity conditions for assessment of central and peripheral cardiovascular dynamics and assessment of crewmembers orthostatic tolerance status. The cardiovascular response to lower body negative pressure has been studied in considerable detail (4-6, 14-16). Additionally, some attention has been given to the application of long term LBNP as a countermeasure against vascular "deconditioning" (17, 18). Consideration and rationale for the use of these particular incremental levels of negative pressure have been studied (19) although no thorough studies have been performed using constant, incremental, pulse and sinusoid input levels of negative pressure. In the present experiment, the LBNP served as a simulator of orthostatic stress and no anti-deconditioning effect was expected. The LBNP protocol used for all phases of the Skylab program is identical to that used for the Apollo pre and postflight orthostatic evaluation (10).

The LBNP (M092) experiment served as a very useful stress test since the negative pressure protocol was of sufficient magnitude to cause early termination or presyncopal symptoms in-flight for 2 of the 3 crewmembers while no preflight early terminations were observed for these crewmembers. The more frequent early terminations in-flight suggests that either the crew's successful adaptation to the weightless environment rendered them slightly less tolerant of this provacative test or that the test as presented

in zero gravity comprised a stress slightly different from that of the earth environment. It can be convincingly argued that, although there were wide variations in the rate of change of negative pressure levels which complicated the analysis of calf volume change, these variations would not account for the increased frequency of early terminations or the greatly increased volume changes. It appears that the relatively empty veins of the lower extremities constituted one important reason for the significantly different response in calf volumes observed between preflight and in-flight LBNP tests.

In addition to the increased frequency of in-flight early terminations and the alteration of the LBNP protocol for two of the Skylab 2 crewmembers, the end of period calf volume changes during the in-flight phase verified that the crewmembers had indeed experienced adjustments within the cardiovascular system. The dramatic increase in EOP PLVC values apparent on the first LBNP test and persisting throughout the in-flight phase can be attributed to several phenomena. It is readily apparent that the amount of blood within the veins of the lower extremities at the beginning of an LBNP test must be a contributing factor that determines the extent of calf volume change that will be observed on LNBP tests. The large volumes of blood that pooled in the -8, -16 and early part of the -30 mm Hg periods provide considerable evidence for a relatively empty venous system in the lower extremities. Since 80% of the total EOP PLVC in-flight increase occurred within the first 2 minutes (-8 and -16 mm Hg) of the LNBP test, support for rapid distention of the partly empty venous reservoirs of the lower body and with some diuresis one would expect that the LNBP test in weightlessness would be more stressful than the preflight tests. While the extent of physical filling of the veins probably accounts for a major percentage of the increased calf volume change observed in-flight, there are several other conditions which might have contributed to larger EOP PLVC values. A change in the distensibility of the elastic properties of the leg veins via hormonal, biochemical or neuronal alteration of sympathetic traffic could affect both the rate and magnitude of

calf volume change. Lastly, the in-flight PLVC values could seem slightly larger because of the decrease in leg circumference. If only the same amount of blood was pooled in-flight as preflight, the in-flight PLVC would undergo an apparent increase in percent leg volume change due to the 7% decrease in leg circumference. This 10 to 15% decrease in calf volume could significantly affect the apparent PLVC as measured in-flight. All of these factors could contribute to the increased PLVC values observed in-flight; however, future experiments preferably in zero gravity but possibly in bed rest studies must determine their relative influence.

Since the EOP PLVC were considerably greater in-flight, either the S1 or the S2 slope or both slopes must be the causative factors. The graphs of Figures 44 to 46 indicate the relative in-flight change in all of the leg volume parameters in comparison to preflight values for each crewmember. The plotted data represent the average values of EOP PLVC, S1 and S2 slopes for each crewmember expressed as a ratio of his preflight averages. These graphs clearly indicate the relative changes in each parameter from preflight as well as provide an overview of changes occurring in all of the computed values. With the exception of the S2 slope data, the computed values appear reasonably consistent among the three crewmembers. Figure 47 indicates the mission averages for the computed values of EOP PLVC, S1 and S2 slopes. Analysis of this average data indicates that both the S1 and S2 slopes contribute to the larger EOP PLVC at the -8 and -16 mm Hg in-flight values while only the S2 slope contributes to increased EOP PLVC at greater levels of negative pressure. The increased S1 slope values particularly at the -8 mm Hg level of pressure must have resulted primarily from the rapid distention of the partially empty lower extremity veins. It is possible that some increase in the S1 slope values at the initial level of negative pressure could have resulted from physiological alterations in venomotor tone or intrinsic changes in smooth muscle properties or changes of a biochemical or hormonal nature. However, changes of this nature cannot be accepted as the principal reason for increased EOP calf volume changes since these types of physiological alterations should

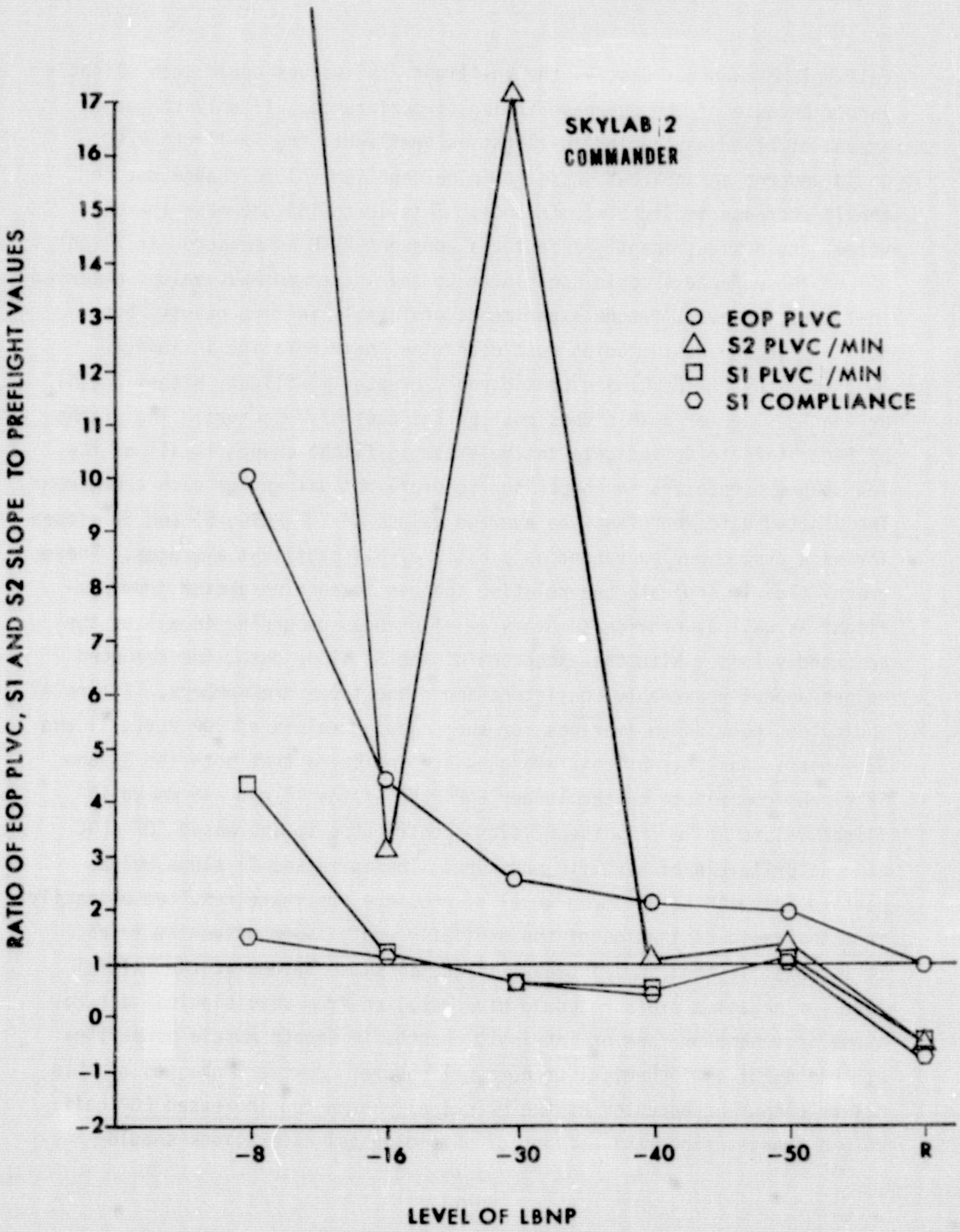

FIGURE 44. SUMMARY GRAPH OF IN-FLIGHT EOP PLVC, S1 AND S2 SLOPE DATA RELATIVE TO PREFLIGHT VALUES.

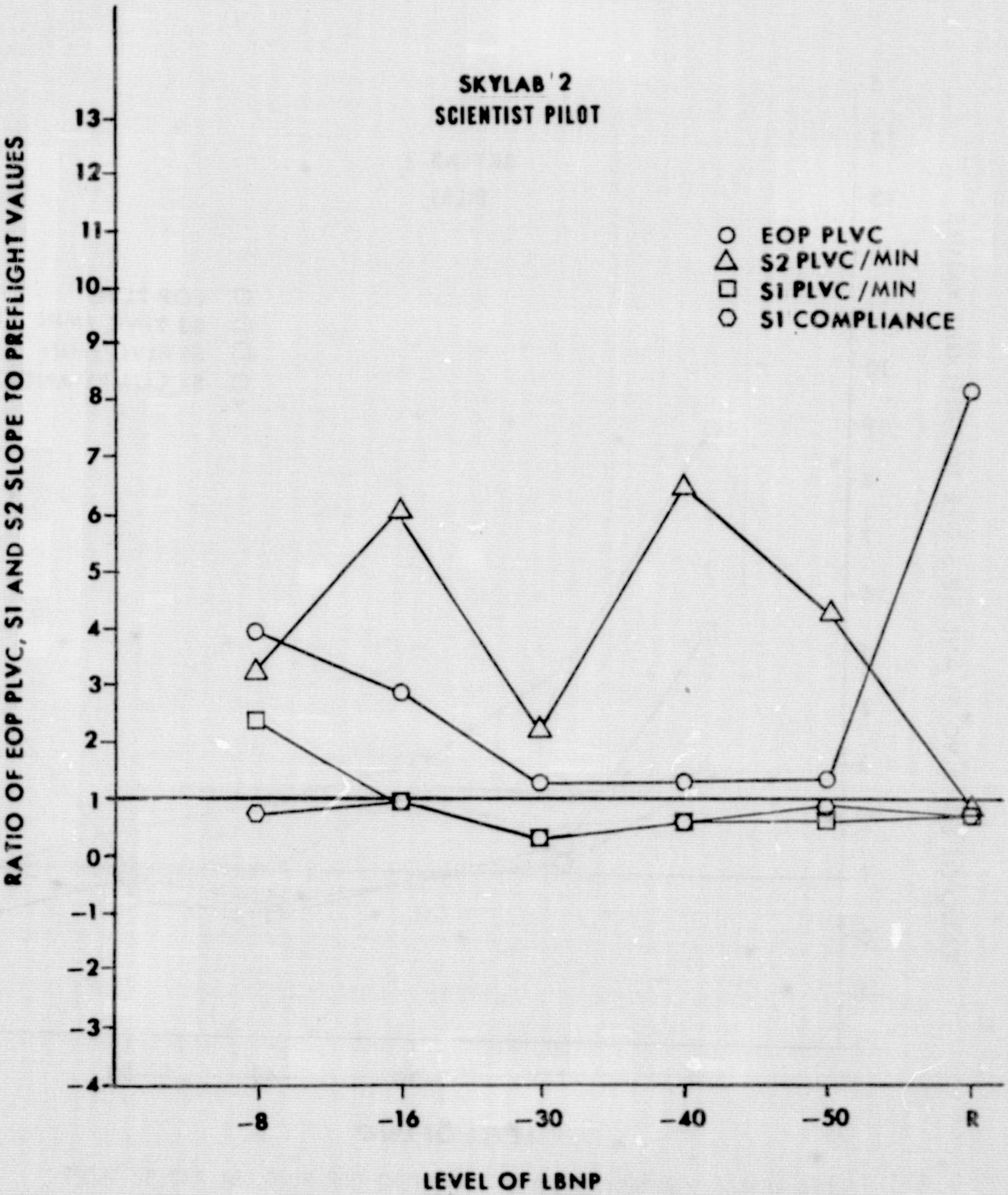

FIGURE 45. SUMMARY GRAPH OF IN-FLIGHT EOP PLVC, S1 AND S2 SLOPE DATA RELATIVE TO PREFLIGHT VALUES.

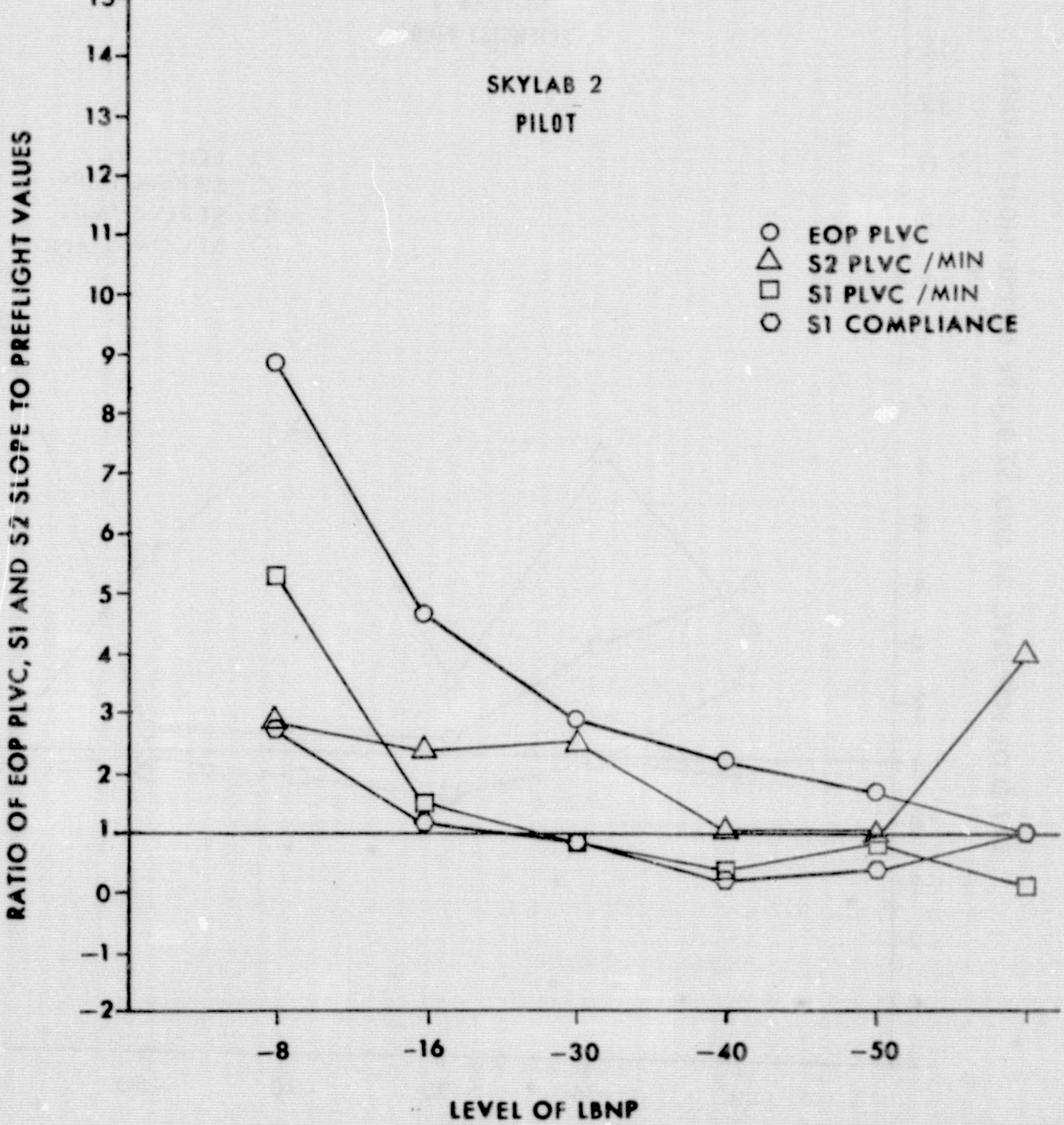

FIGURE 46. SUMMARY GRAPH OF IN-FLIGHT EOP PLVC, S1 AND S2 SLOPE DATA RELATIVE TO PREFLIGHT VALUES.

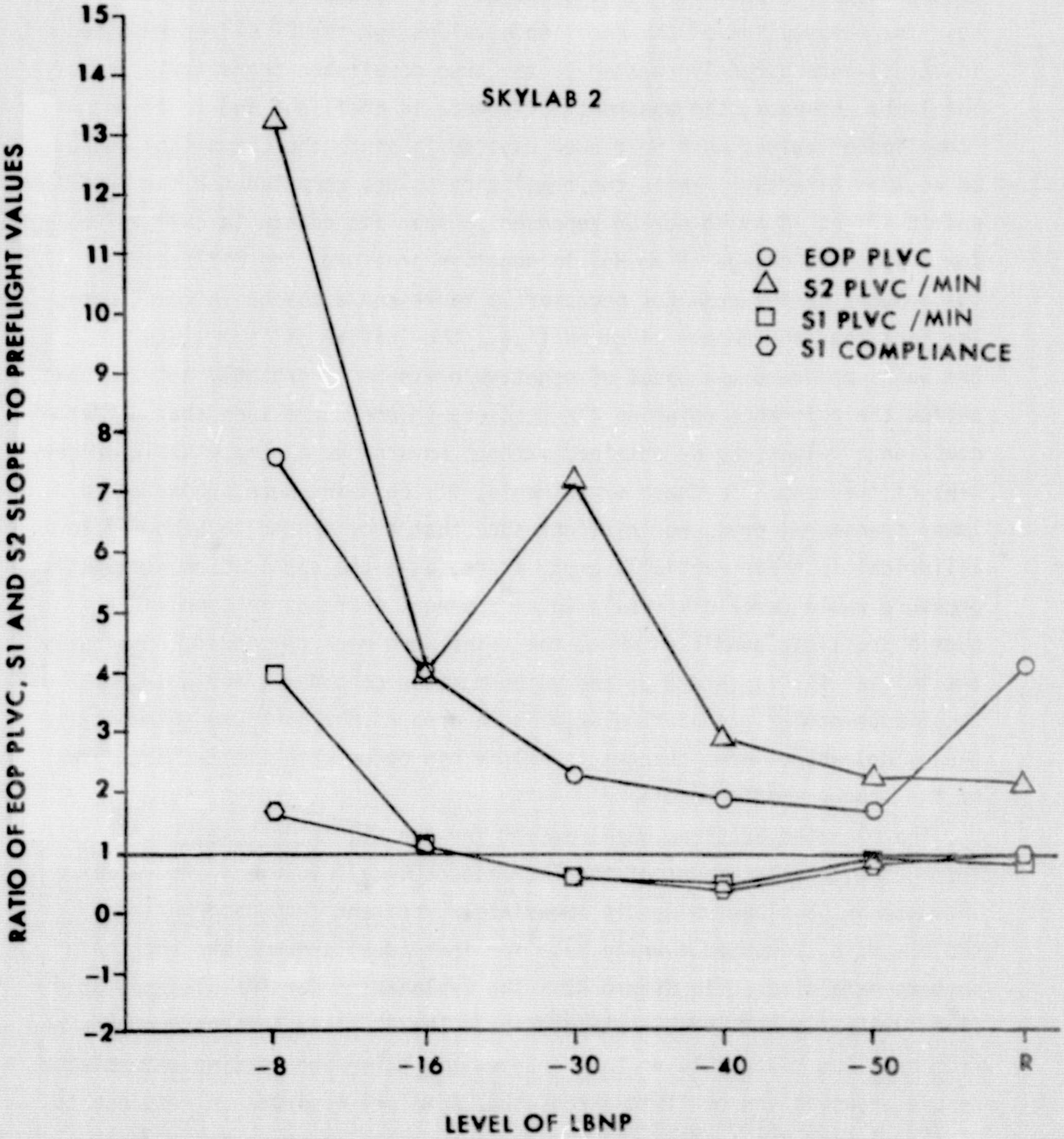

FIGURE 47. SUMMARY GRAPH OF AVERAGE (ALL CREW MEMBERS) IN-FLIGHT EOP PLVC, S1 AND S2 SLOPE DATA RELATIVE TO PREFLIGHT VALUES.

manifest their effect at levels of negative pressure other than just -8 mm Hg. The computation of the compliance values for the S1 slopes resulted in values more directly related to the true compliance characteristics of the limb. However, the apparent difference in preflight and in-flight "compliance" values must be viewed cautiously since the comparison cannot be equated directly. While the compliance values computed for the preflight and in-flight -8 mm Hg period represent a specific change in calf volume for a specific change (8 mm Hg) in negative pressure, the difference in the volumes pooled does not necessarily represent a change in compliance. The fact that the amount of blood (i.e., the initial filling state) in the veins prior to the onset of negative pressure is probably not the same, shifts the reference point on the pressure-volume curve such that different compliance values can be obtained without any change in the elastic properties of the vein. In these experiments, if the veins were subjected to lower transmural pressure in-flight such that they tended to become more elliptical in their partially empty state, then the application of negative pressure would certainly result in an apparent increase in compliance over a preflight condition where the veins were more distended. Obviously the initial filling state of the veins must be considered for a true compliance comparison particularly in an area of the pressure volume curve (-8 mm Hg) where large changes in volume can occur with little stretching of the venous smooth muscle.

The elevated S2 slope data, except for the -50 mm Hg level, accounts for a considerable amount of the increased EOP calf volume. The relative increase in S2 slope values is immediately apparent from observation of the raw data, computed average data for individual crewmembers and the summary data plotted in Figure 47. The explanation for the elevated S2 slope values is not immediately obvious. The S2 slope information obtained from previous tilt-table or LNBP orthostatic tolerance testing was related to the transudation of fluid across the capillary membrane in response to altered transmural conditions. There is evidence in these experiments to support increased fluid shifts from the vascular to extravascular

compartments during the in-flight phase. The highly variable, though increased, S2 slope values in combination with a larger residual calf volume during the recovery portion of the experiments indicate that a greater amount of fluid was shifted in-flight. The relative contribution of various factors such as increased compliance, diminished interstitial fluid pressure, the role of supporting tissue and alteration in venomotor tone could not be assessed in these experiments, but most likely all of these factors are of importance and contribute in varying degrees to the EOP PLVC and slope data.

There are many factors which possibly could have affected the outcome of the M092 LNBP experiment. Certainly the extremely elevated ambient temperatures within the Skylab workshop particularly during the initial portion of the mission were contributory to the severe adjustments in water and electrolyte balance and endocrine responses (22). The magnitude of the effect of a number of experiment procedures for blood sampling, EVAs or other routines which prevented rigid adherence to testing schedules is difficult to assess. These factors plus other involved neurohormonal adjustment of adaptation must certainly have altered the crew's LBNP response. Nevertheless, it is remarkable that within the constraints of such a demanding experiment schedule and a small population sample so much information and knowledge has been obtained concerning man's basic adaptability to the new environment of space.

CONCLUSIONS

The Skylab crew exhibited an immediate increase in calf volume in response to the first in-flight lower body negative pressure experiment. These values, though highly variable, remained elevated throughout the in-flight phase with a slight tendency to decrease in magnitude. Increases were significant for all levels of negative pressure for the commander and pilot and significantly increased at the -8, -16 and -30 mm Hg levels for the scientist pilot. At least 80% of the total increase in the end of period calf volume change occurred within the -8 and -16 mm Hg pressure level indicating the partially empty status of the veins of the lower extremities.

The incidence of early terminations and syncopal episodes during in-flight LNBP tests as a result of the increased fluid pooling in the lower body indicated a significant loss of orthostatic tolerance which remained throughout the in-flight phase. The combination of more frequent early terminations and strikingly increased calf volume changes probably indicate that the level of in-flight negative pressure represented a greater cardiovascular stress than did the preflight protocol.

The S1 slope computation indicated increased rates of filling at the -8 and -16 mm Hg levels and decreased rates at -30, -40 and -50 mm Hg levels. The runoff or recovery slope values remained essentially the same as preflight values. The increased S1 slope values reflect the rapid filling of the partially empty venous reservoirs which probably influences the filling curve at greater levels of negative pressure. These rates reflect the possible alterations in the compliance characteristics of the lower limbs.

The S2 slope values, though increased, were widely varying and demonstrated the greatest increase at the -8, -16 and -30 mm Hg levels of pressure. The increases probably reflect the diminished interstitial fluid pressure in-flight in combination with the effects of the initial rapid filling and distention of the veins during application of LBNP.

In-flight measurements of body mass and calf circumference indicate an early, large reduction in both parameters. The initial loss of volume from the legs appeared to correlate with the cephalad fluid shift and onset of cranial and cervical congestion. Both parameters tended to stabilize with a slightly decreasing trend after the initial shift.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the support and assistance from the many people who contributed technical assistance to the collection and processing of the leg volume data obtained from the Skylab Medical Experiments. Particular appreciation is due the NASA-JSC personnel: R. L. Johnson, G. W. Hoffler, A. E. Nicogossian, M. M. Jackson and R. W. Nolte and other members of the cardiovascular laboratory team. Appreciation is extended to Mrs. Dolores T. Tomlinson for assistance with data processing and to Ms. Pat Karasch for typing assistance.

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APPENDIX A

SUMMARY OF PLETHYSMOGRAPHS AND ASSOCIATED CALIBRATION DATA

LVMS CALIBRATION CURVE DATA

VOLTAGE AT INDICATED VOLUME CHANGE

BAND ID		SER. NO.	BAND SIZE	BAND DESIG.	CAL. NO.	-1 %	0 %	1 %	2 %	3 %	4 %	5 %	CYL. SIZE	DATE OF TEST
AF	*	048	14-15	FTTH	3.7	0.26	0.83	1.45	2.16	3.01	3.81	4.66	14.5	21 MAY 73
AG		049	15-16	FTTH	3.7	0.32	0.83	1.35	1.95	2.63	3.34	4.09	15.5	02 APR 73
AM	*	055	13-14	FTTH	3.5	0.31	0.83	1.34	1.92	2.47	3.16	3.80	13.5	23 MAY 73
AR		060	13-14	FTTH	3.3	0.24	0.83	1.46	2.10	2.81	3.64	4.48	13.5	22 MAY 73
AS	*	061	13-14	FTTH	3.5	0.30	0.83	1.39	1.99	2.61	3.25	4.00	13.5	06 MAR 73
AT		062	13-14	FTTH	4.0	0.22	0.83	1.50	2.15	2.89	3.65	4.48	13.5	22 MAY 73
AV	*	064	13-14	FTTH	3.5	0.26	0.83	1.43	2.04	2.70	3.42	4.25	13.5	05 MAR 73
AY	*	067	13-14	FTTH	3.9	0.40	0.83	1.34	1.87	2.42	3.02	3.68	13.5	12 FEB 73
AZ	*	068	13-14	FTTH	3.9	0.35	0.83	1.36	1.92	2.53	3.20	3.86	13.5	26 JUL 73
BF	*	074	15-16	FTTH	3.2	0.34	0.83	1.40	2.00	2.66	3.44	4.24	15.5	12 FEB 73
BL	*	080	14-15	FTTH	3.9	0.41	0.83	1.30	1.82	2.42	2.97	3.58	14.5	02 APR 73
BP	*	084	14-15	FTTH	3.1	0.27	0.83	1.40	2.00	2.68	3.37	4.11	14.5	26 FEB 73
BQ	*	085	14-15	FTTH	3.3	0.31	0.83	1.40	2.04	2.80	3.54	4.33	14.5	22 FEB 73
BS		087	14-15	FTTH	3.5	0.35	0.83	1.33	1.95	2.65	3.33	4.09	14.5	06 MAR 73
BT	*	088	14-15	FTTH	3.1	0.33	0.83	1.38	2.04	2.76	3.49	4.27	14.5	02 APR 73
BX	*	092	14-15	FTTH	3.4	0.25	0.83	1.46	2.24	3.08	3.90	4.68	14.5	18 MAY 73
BY	*	093	14-15	FTTH	3.7	0.39	0.83	1.33	1.92	2.57	3.22	3.92	14.5	02 APR 73
CB	*	096	15-16	FTTH	3.4	0.24	0.83	1.46	2.17	2.89	3.76	4.63	15.5	02 APR 73
CD		098	16-17	FTTH	3.3	0.24	0.83	1.53	2.19	2.97	3.82	4.72	16.5	21 MAY 73
CE	*	099	16-17	FTTH	2.8	0.19	0.83	1.51	2.22	3.03	3.96	4.81	16.5	12 MAR 73
CG		101	16-17	FTTH	3.2	0.25	0.83	1.41	2.08	2.69	3.51	4.29	16.5	12 MAR 73
CL		106	14-15	FTTH	3.[illegible]	0.35	0.83	1.36	1.98	2.54	3.26	3.98	14.5	02 JUL 73
DB		107	14-15	FTTH	2.[illegible]	0.35	0.83	1.34	1.94	2.60	3.27	3.98	14.5	07 MAR 73

* INDICATES BANDS LATER USED AS MLU LEG BANDS

IVMS CALIBRATION CURVE DATA

BAND ID	SER. NO.	BAND SIZE	BAND DESIG.	CAL. NO.	VOLTAGE AT INDICATED VOLUME CHANGE -1 %	0 %	1 %	2 %	3 %	4 %	5 %	CYL. SIZE	DATE OF TEST
AL	054	16-17	MLU	2.9	0.21	0.83	1.48	2.13	2.86	3.68	4.53	16.5	06 APR 73
AP	058	13-14	MLU	3.0	0.37	0.83	1.33	1.84	2.41	3.07	3.64	13.5	13 MAR 73
AU	063	13-14	MLU	3.2	0.26	0.83	1.45	2.08	2.88	3.68	4.50	13.5	28 AUG 73
CY	065	13-14	MLU	3.6	0.36	0.83	1.36	1.90	2.49	3.12	3.82	13.5	10 APR 73
BA	069	14-15	MLU	3.1	0.31	0.83	1.38	1.92	2.58	3.25	3.96	14.5	20 MAR 73
BB	070	14-15	MLU	3.3	0.34	0.83	1.36	1.98	2.72	3.48	4.23	14.5	09 APR 73
BC	071	14-15	MLU	3.6	0.26	0.83	1.46	2.24	3.12	3.96	4.70	14.5	29 AUG 73
BD	072	15-16	MLU	3.4	0.25	0.83	1.51	2.19	2.93	3.73	4.59	15.5	16 APR 73
BE	073	15-16	MLU	3.0	0.28	0.83	1.40	2.01	2.66	3.38	4.11	15.5	04 APR 73
BG	075	16-17	MLU	3.2	0.28	0.83	1.44	2.08	2.78	3.53	4.29	16.5	09 APR 73
BH	076	16-17	MLU	3.6	0.22	0.83	1.49	2.25	3.07	4.07	4.88	16.5	22 MAR 73
CC	097	15-16	MLU	3.0	0.25	0.83	1.47	2.17	2.88	3.71	4.56	15.5	04 APR 73
CF	099	12-13	MLU	3.6	0.42	0.83	1.36	1.91	2.45	3.07	3.90	12.5	28 AUG 73
CG	101	12-13	MLU	3.9	0.41	0.83	1.33	1.84	2.41	3.05	3.73	12.5	27 JUL 73

EVMS CALIBRATION CURVE DATA

VOLTAGE AT INDICATED VOLUME CHANGE

BAND ID	SER. NO.	BAND SIZE	BAND DESIG.	CAL. NO.	-1 %	0 %	1 %	2 %	3 %	4 %	5 %	CYL. SIZE	DATE OF TEST
AC	045	12-13	FLT.	4.5	0.46	0.83	1.33	1.85	2.33	2.95	3.70	12.5	06 SEP 73
AD	046	14-15	FLT.	3.4	0.30	0.83	1.35	2.14	2.70	3.40	4.16	14.5	07 DEC 72
AJ	052	12-13	FLT.	3.5	0.46	0.83	1.30	1.75	2.23	2.79	3.49	12.5	06 SEP 73
AN	056	13-14	B.U.	3.7	0.41	0.83	1.29	1.83	2.37	2.94	3.54	13.5	05 FEB 73
AQ	059	13-14	B.U.	3.2	0.15	0.83	1.57	2.36	3.12	3.92	4.79	13.5	06 FEB 73
AX	066	13-14	FLT.	3.7	0.41	0.83	1.32	1.87	2.44	3.08	3.75	13.5	05 DEC 72
BJ	078	14-15	FLT.	3.2	0.46	0.83	1.30	1.85	2.48	3.10	3.75	14.5	05 DEC 72
BK	079	14-15	FLT.	3.6	0.41	0.83	1.29	1.83	2.43	3.04	3.68	14.5	06 DEC 72
BU	089	14-15	FLT.	3.5	0.34	0.83	1.36	1.97	2.66	3.32	4.06	14.5	07 DEC 72
BV	090	14-15	FLT.	3.6	0.41	0.83	1.29	1.79	2.41	3.01	3.76	14.5	06 DEC 72
BZ	094	15-16	FLT.	3.3	0.32	0.83	1.39	1.97	2.61	3.33	4.13	15.5	06 DEC 72
CA	095	15-16	FLT.	3.7	0.26	0.83	1.45	2.10	2.84	3.64	4.52	15.5	05 DEC 72
CH	102	13-14	FLT.	3.2	0.39	0.83	1.32	1.82	2.34	2.94	3.61	13.5	04 DEC 72
CI	103	13-14	FLT.	4.5	0.36	0.83	1.33	1.83	2.35	2.94	3.60	13.5	05 DEC 72
CJ	104	13-14	FLT.	3.5	0.51	0.83	1.23	1.67	2.14	2.69	3.25	13.5	07 DEC 72
CO	109	12-13	FLT.	3.6	0.54	0.83	1.33	1.85	2.32	2.95	3.66	12.5	06 SEP 73
CP	110	15-16	FLT.	3.6	0.33	0.83	1.37	1.96	2.63	3.38	4.15	15.5	06 DEC 72
CR	112	16-17	FLT.	3.6	0.32	0.83	1.42	2.00	2.67	3.39	4.14	16.5	06 DEC 72
CS	113	12-13	FLT.	3.8	0.44	0.83	1.30	1.68	2.42	3.02	3.63	12.5	21 JUN 73
CT	114	12-13	FLT.	4.6	0.46	0.83	1.32	1.80	2.28	2.80	3.33	12.5	20 JUN 73
CU	115	16-17	FLT.	3.2	0.30	0.83	1.41	2.03	2.72	3.52	4.36	16.5	06 DEC 72
CV	116	16-17	FLT.	3.1	0.41	0.83	1.33	1.84	2.44	3.14	3.80	16.5	07 DEC 72
CX	117	14-15	FLT.	3.4	0.45	0.83	1.24	1.72	2.27	2.81	3.36	14.5	06 DEC 72
CY	118	12-13	FLT.	3.4	0.46	0.83	1.35	1.89	2.45	3.12	3.93	12.5	06 SEP 73

LVMS CALIBRATION CURVE DATA

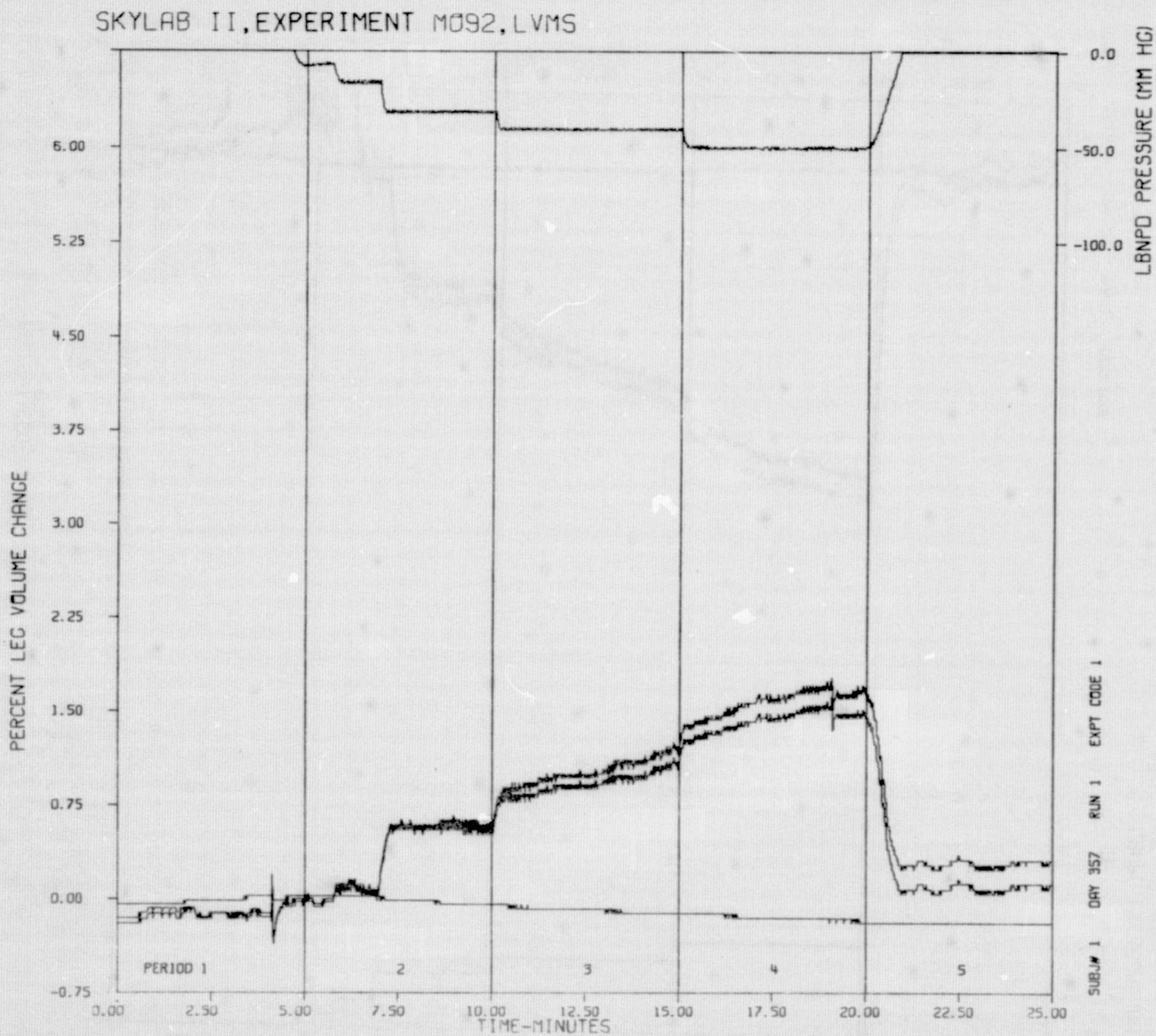
VOLTAGE AT INDICATED VOLUME CHANGE

BAND ID	SER. NO.	BAND SIZE	BAND DESIG.	CAL. NO.	-1 %	0 %	1 %	2 %	3 %	4 %	5 %	CYL. SIZE	DATE OF TEST
AA *	043	12-13	DVTU	3.5	0.33	0.83	1.34	1.89	2.42	3.04	3.66	12.5	13 JUN 73
AB	044	13-14	DVTU	3.4	0.32	0.83	1.36	2.01	2.60	3.29	4.11	13.5	02 JUL 73
AH	050	15-16	DVTU	2.7	0.16	0.83	1.57	2.37	3.15	4.08	4.98	15.5	11 SEP 73
AT	051	15-16	DVTU	3.3	0.26	0.83	1.46	2.15	2.88	3.72	4.60	15.5	29 AUG 73
AK	053	13-14	DVTU	3.2	0.31	0.83	1.41	2.00	2.67	3.45	4.18	13.5	25 JUL 73
AD	057	12-13	DVTU	4.1	0.44	0.83	1.30	1.79	2.32	2.94	3.58	12.5	30 JUL 73
BI	077	16-17	DVTU	3.3	0.23	0.83	1.51	2.24	3.07	3.99	4.79	16.5	03 JUL 73
CZ	081	14-15	DVTU	3.0	0.34	0.83	1.36	2.06	2.87	3.60	4.41	14.5	03 JUL 73
BN	082	14-15	DVTU	3.5	0.29	0.83	1.50	2.16	3.03	3.87	4.52	14.5	02 JUL 73
BO	083	14-15	DVTU	3.5	0.35	0.83	1.39	2.07	2.82	3.56	4.26	14.5	03 JUL 73
CF	100	16-17	DVTU	3.7	0.23	0.83	1.46	2.18	3.09	4.02	4.86	16.5	24 MAY 73
CK	105	14-15	DVTU	3.1	0.29	0.83	1.43	2.12	2.94	3.71	4.53	14.5	03 JUL 73
CN	108	14-15	DVTU	3.7	0.32	0.83	1.41	2.14	2.96	3.73	4.47	14.5	03 JUL 73

* INDICATES BANDS LATER USED AS MLU LEG BANDS

APPENDIX B

PLOTS OF RAW DATA



SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
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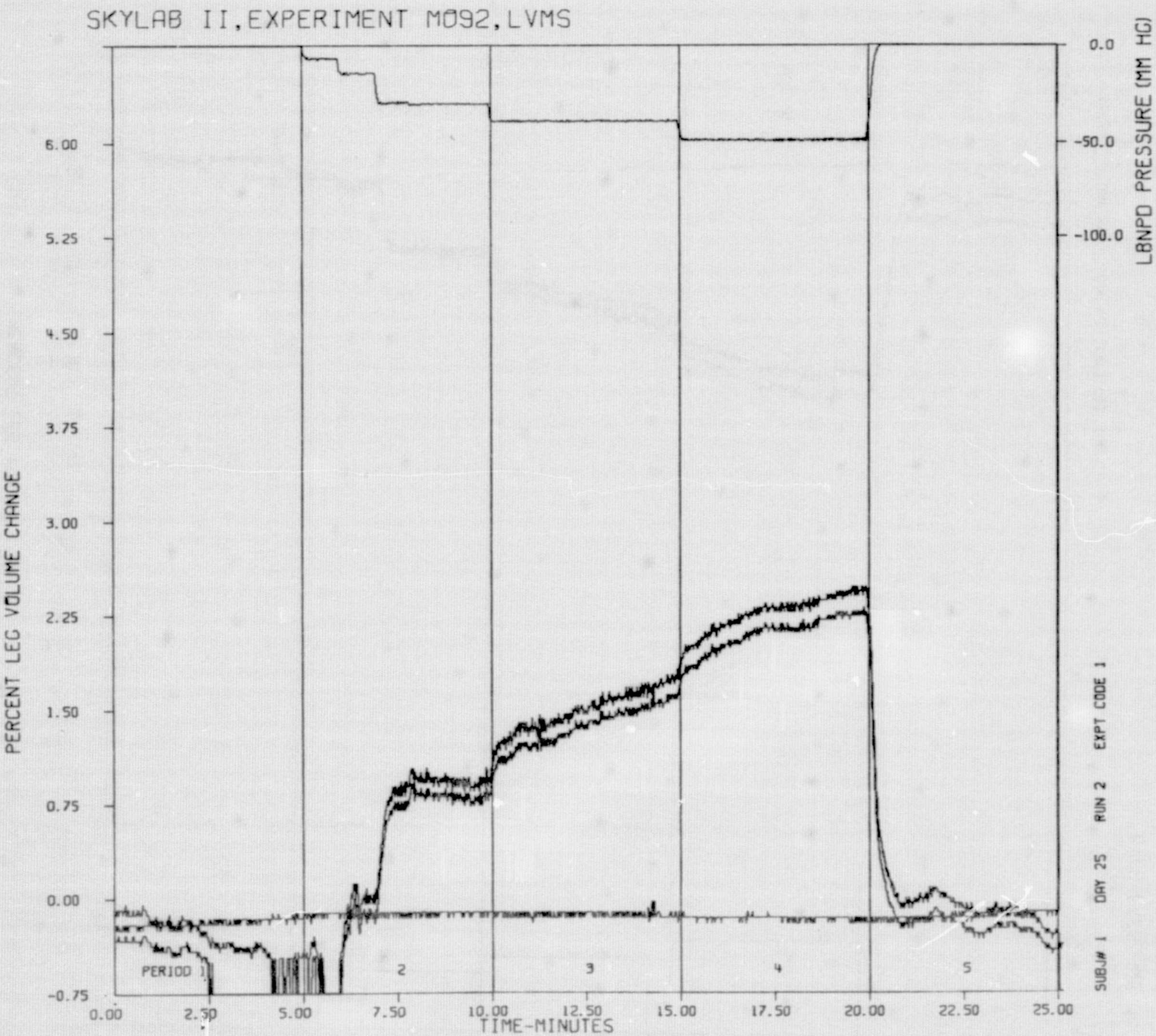
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 1
DAY 357
RUN 1
EXPT CODE 1


SKYLAB II, EXPERIMENT MØ92, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
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4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
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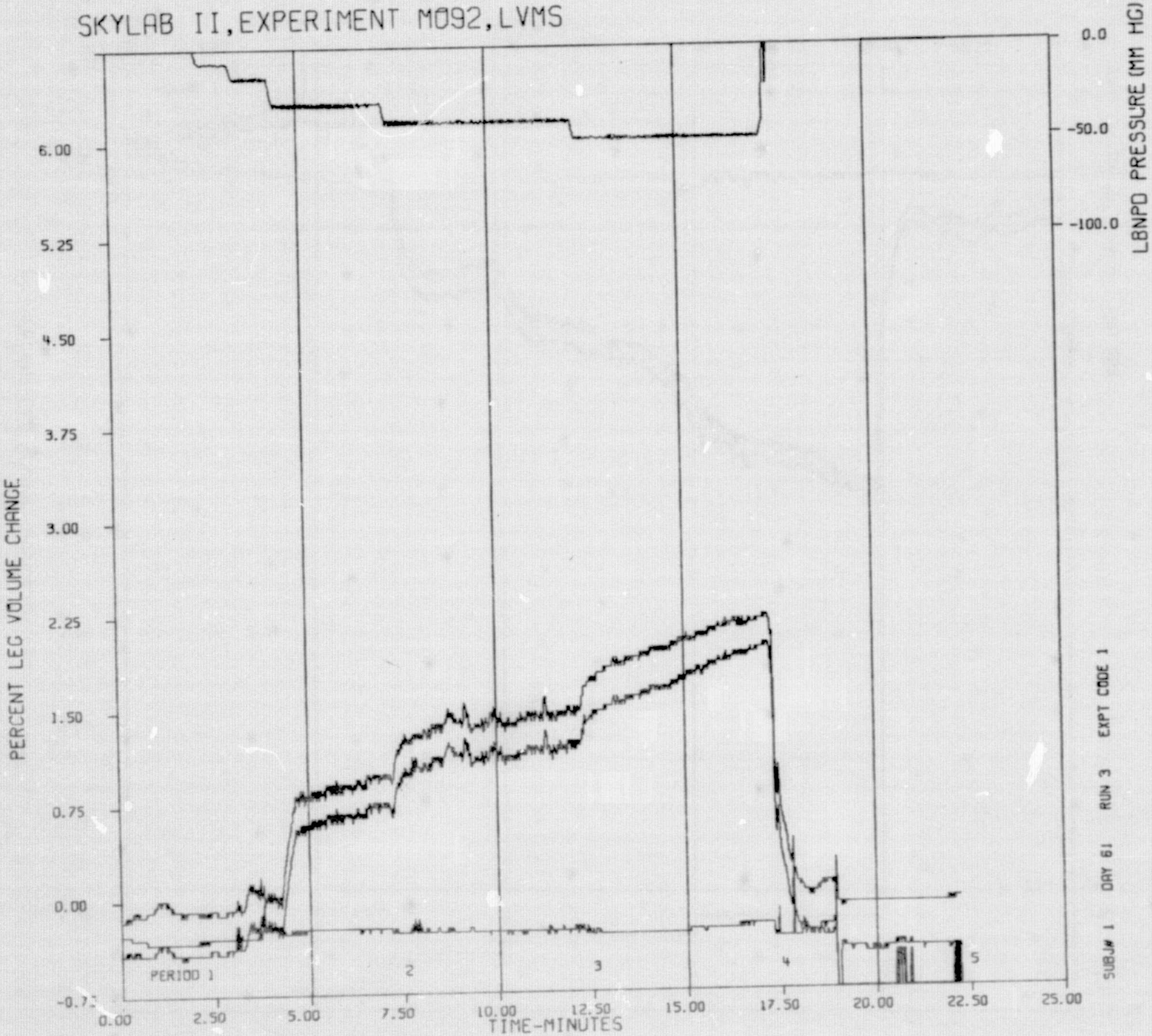
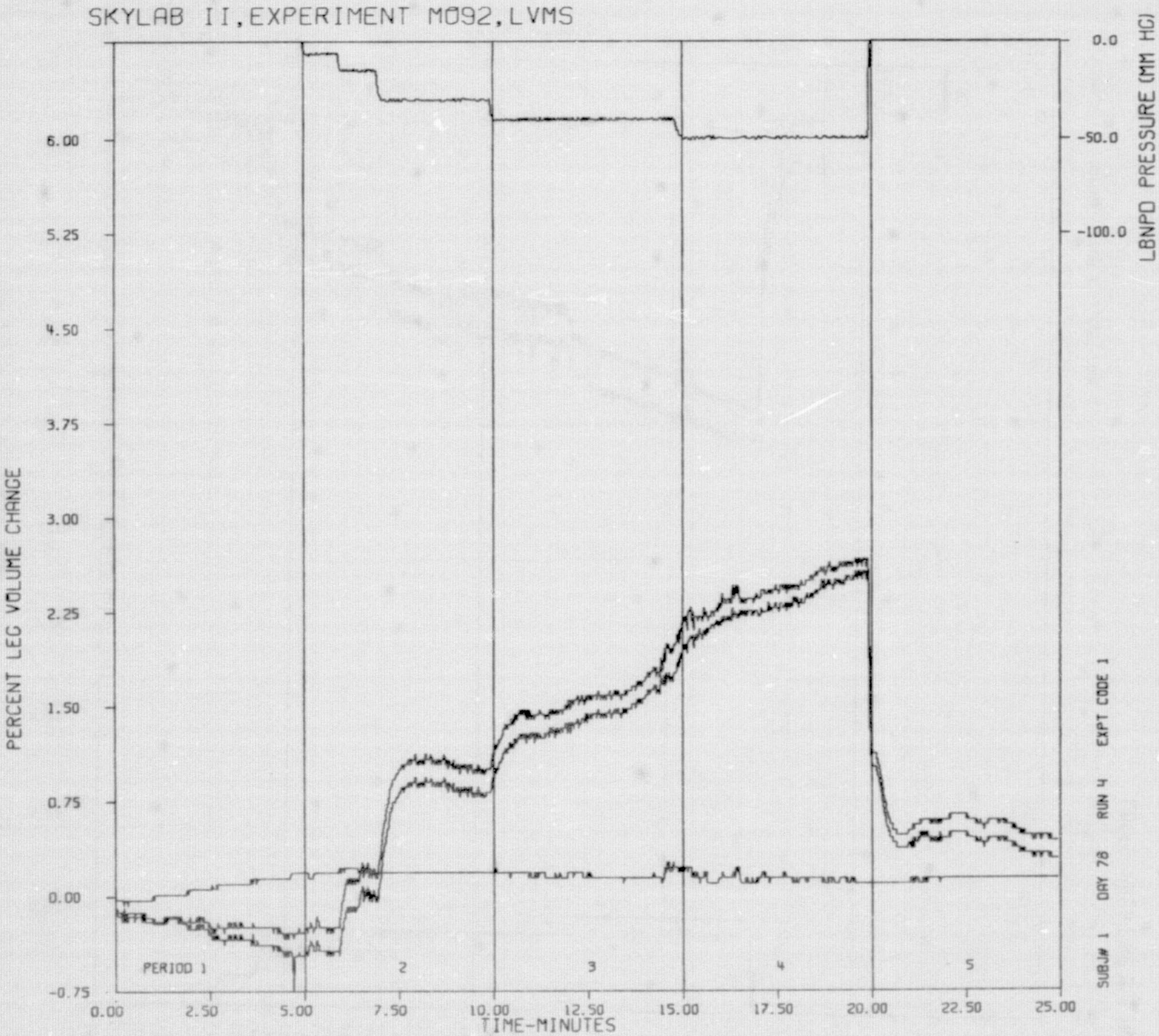


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 61 RUN 3 EXPT CODE 1
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00


SKYLAB II, EXPERIMENT M092, LVMS
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5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
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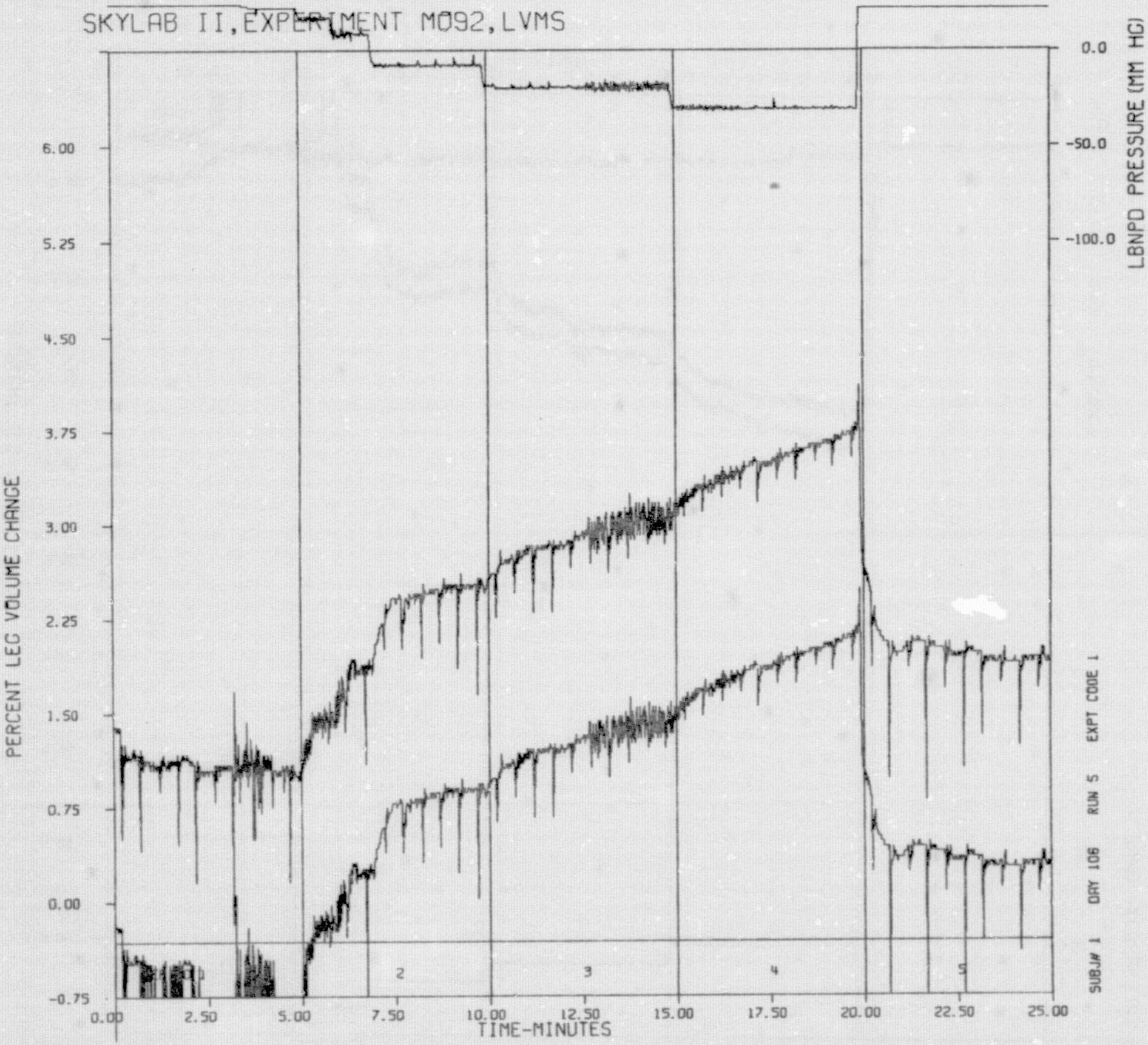
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-100.0
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
2
3
4
5
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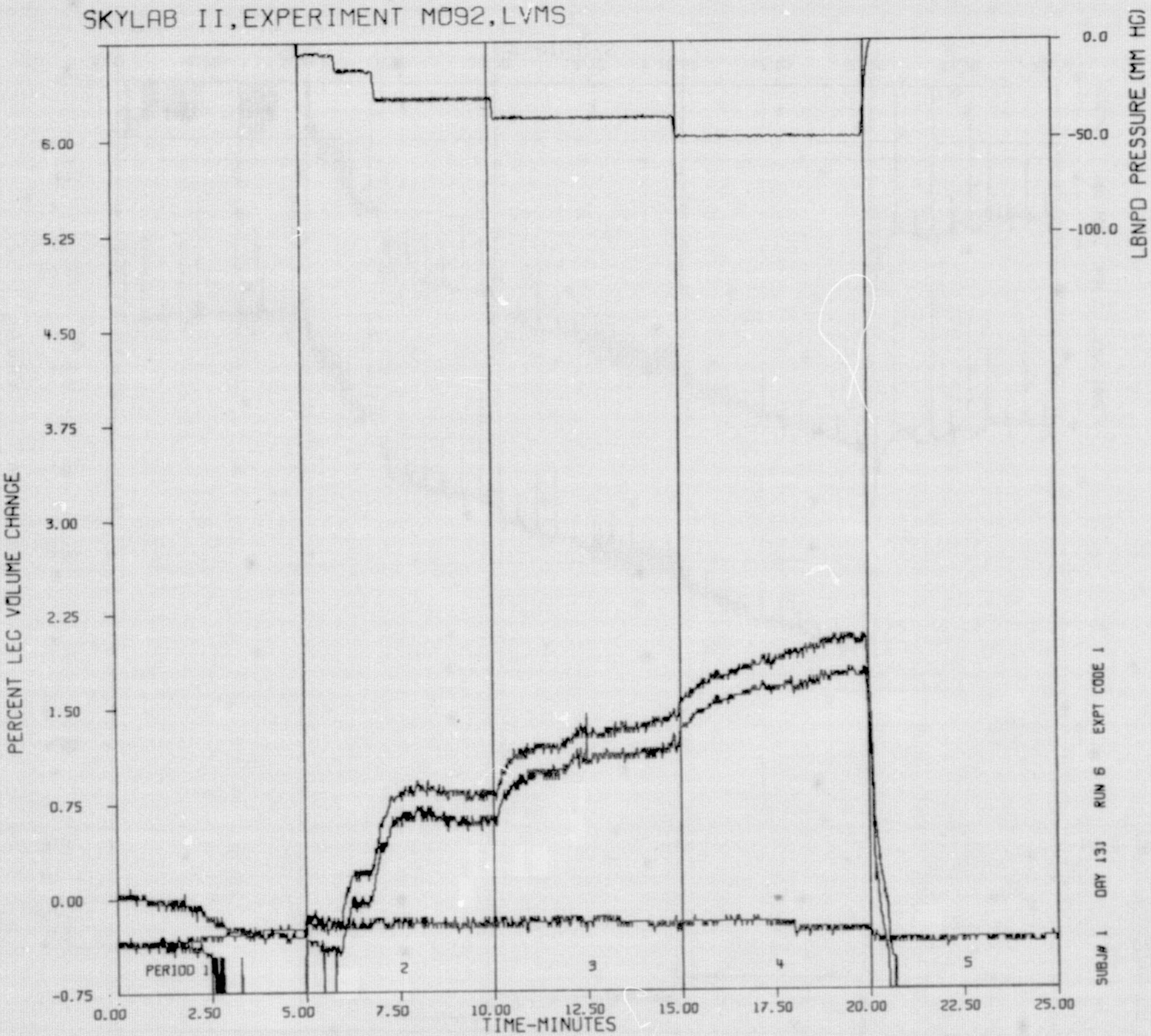
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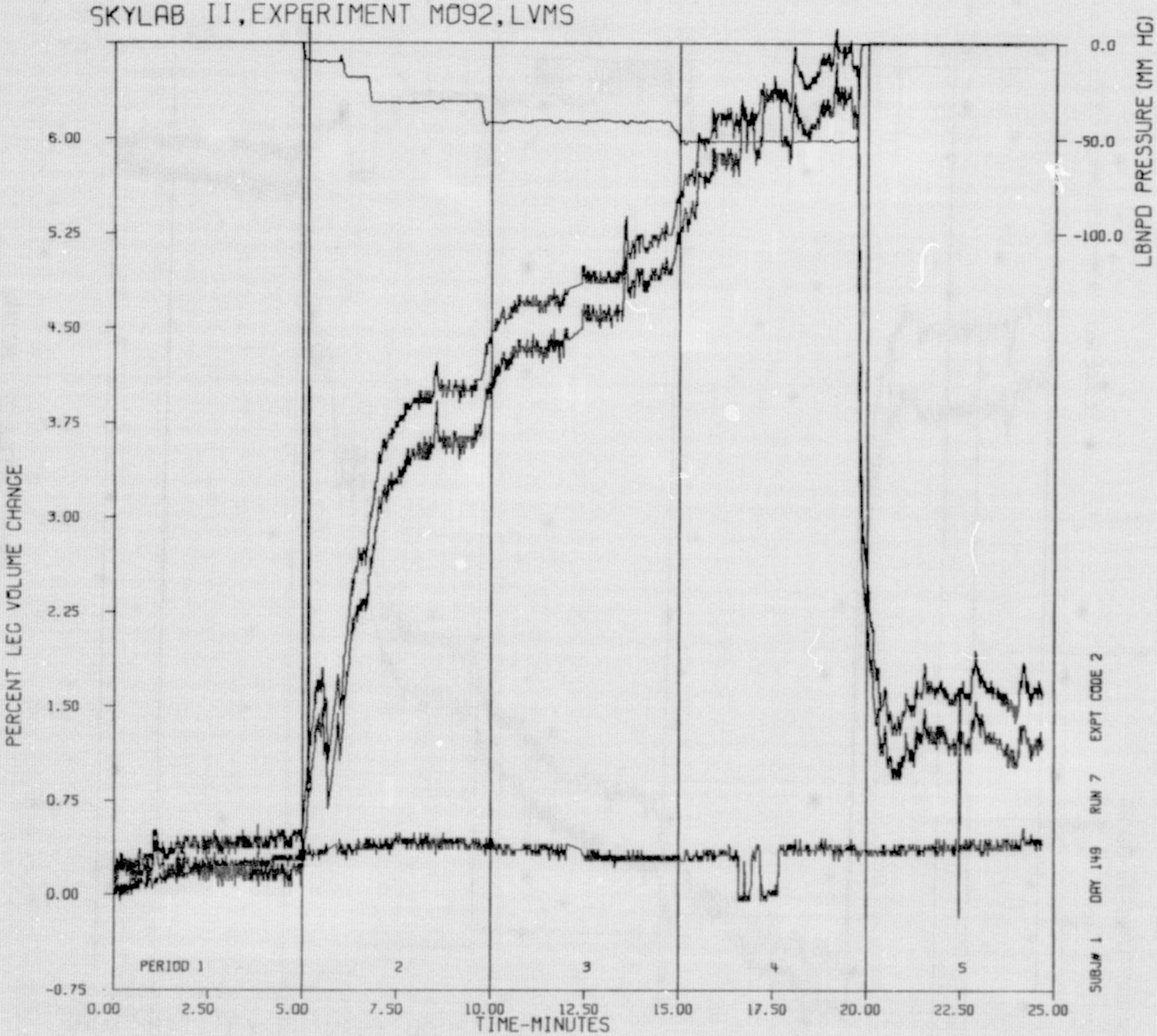
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
SUBJ# 1
DAY 13
RUN 6
EXPT CODE 1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LBNPD PRESSURE (MM HG)
TIME-MINUTES
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5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
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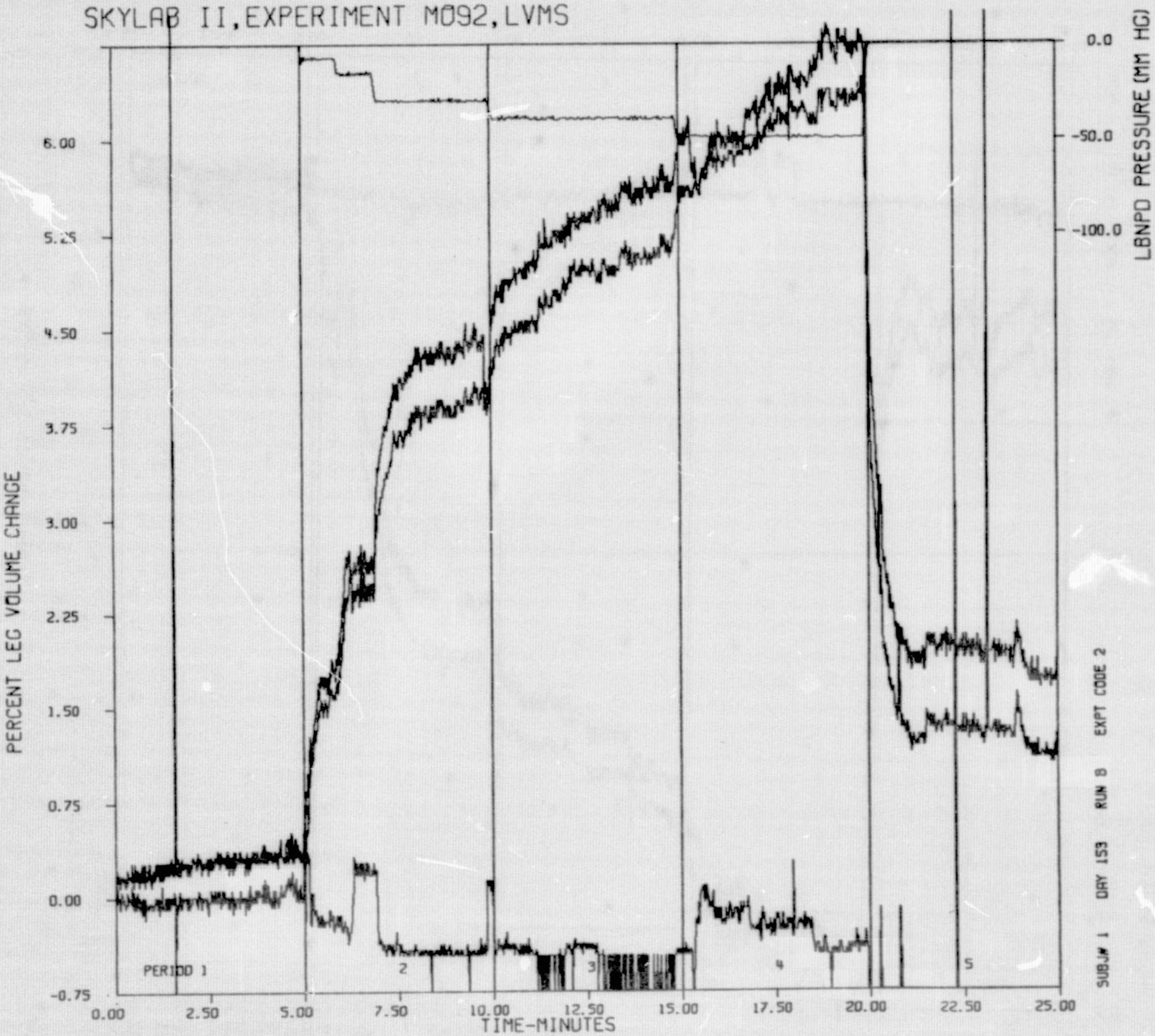

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
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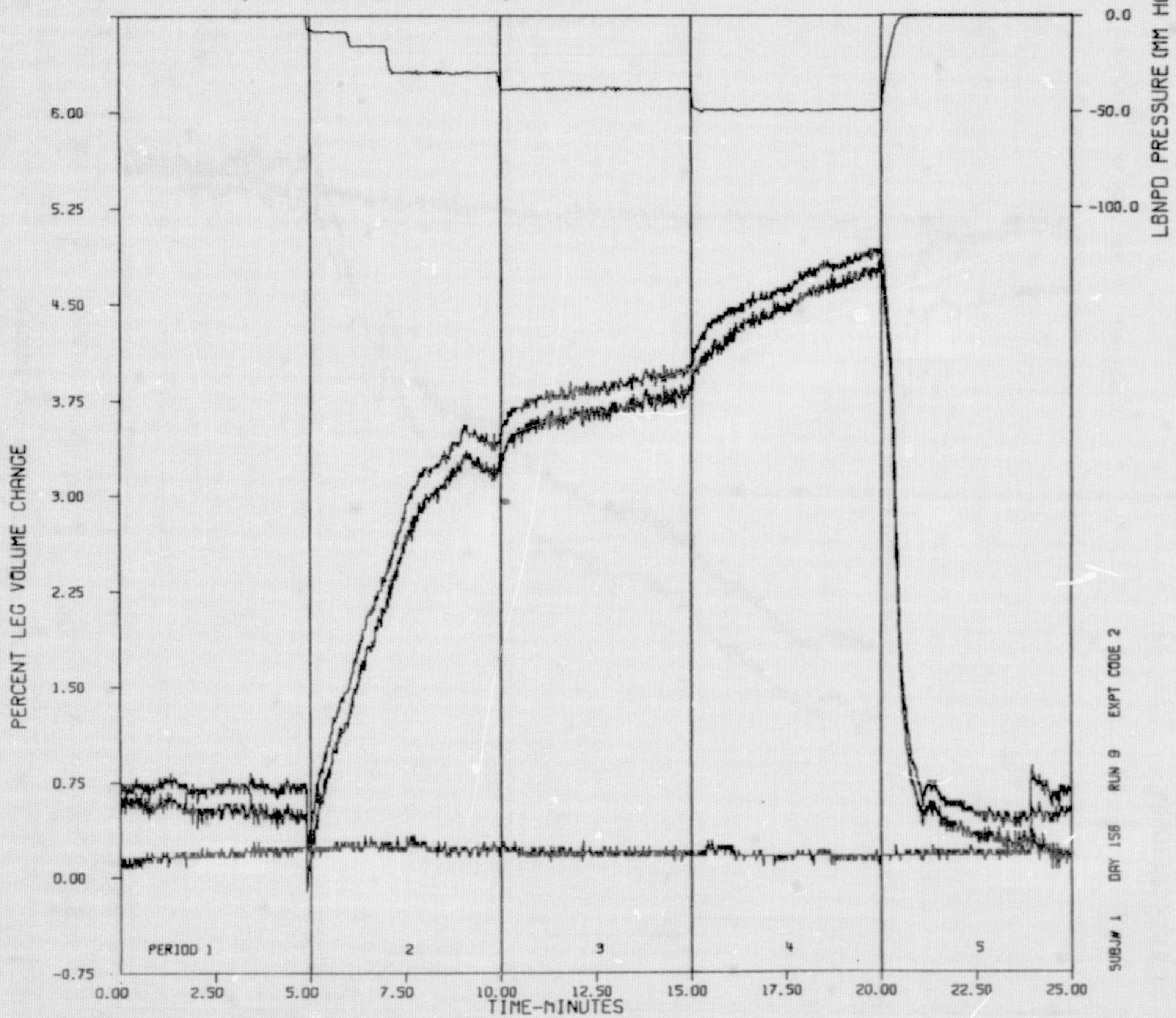
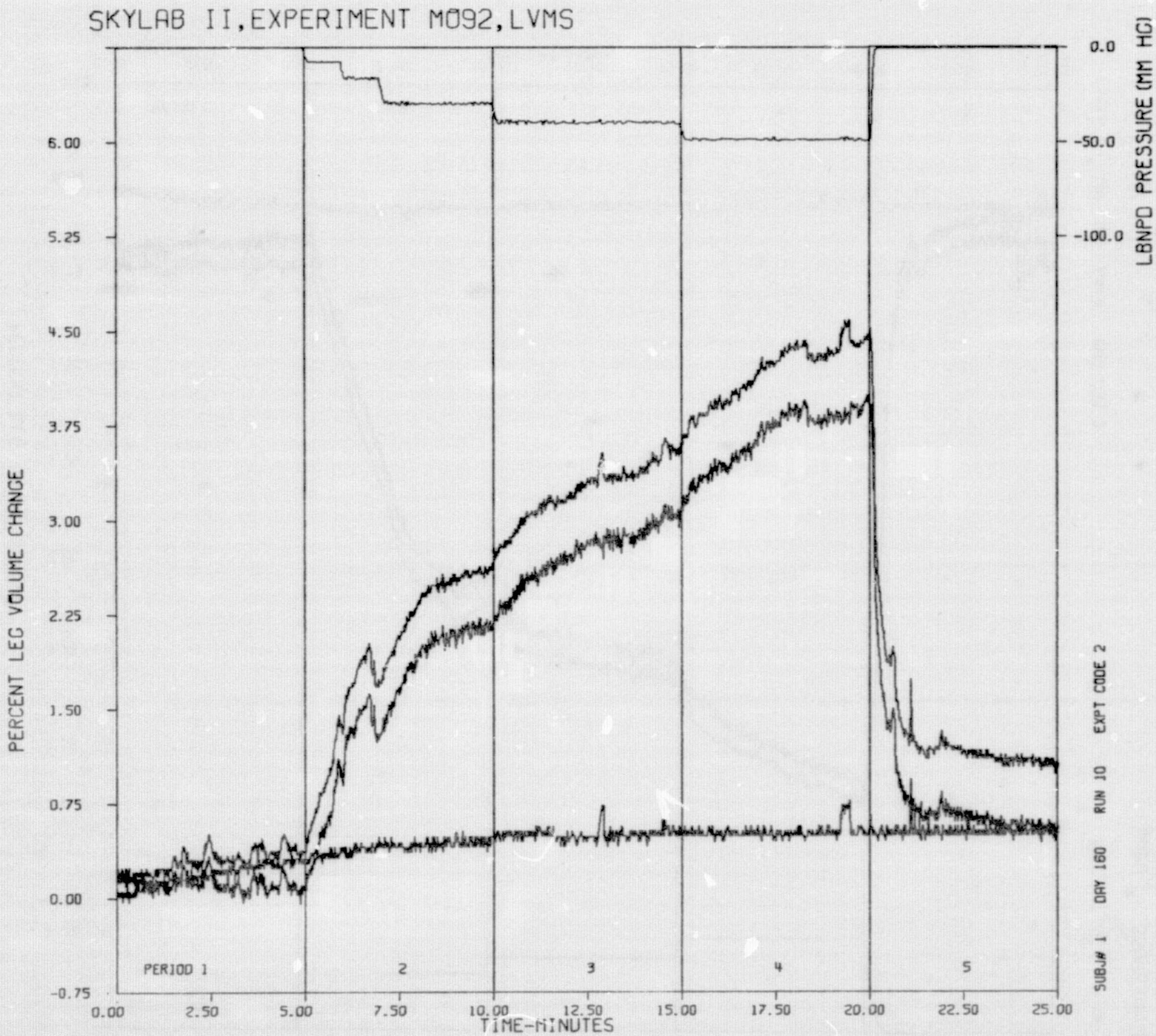
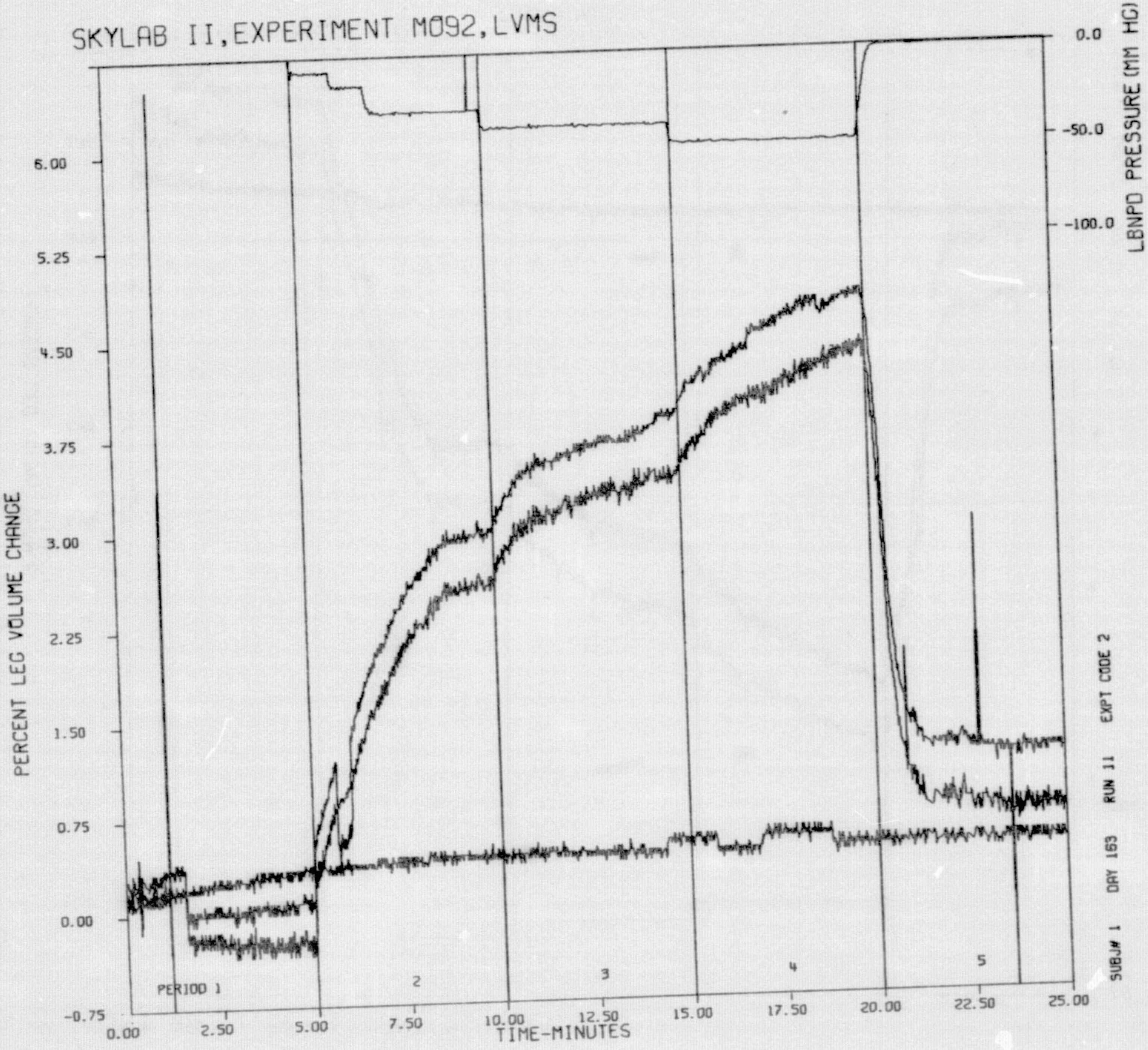
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 153 RUN 8 EXPT CODE 2

SKYLAB II,EXPERIMENT M092,LVMS




SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
-0.75
0.00
0.75
1.50
2.25
3.00
3.75
4.50
5.25
6.00
0.0
-50.0
-100.0
SUBJ# 1 DAY 160 RUN 10 EXPT CODE 2



SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
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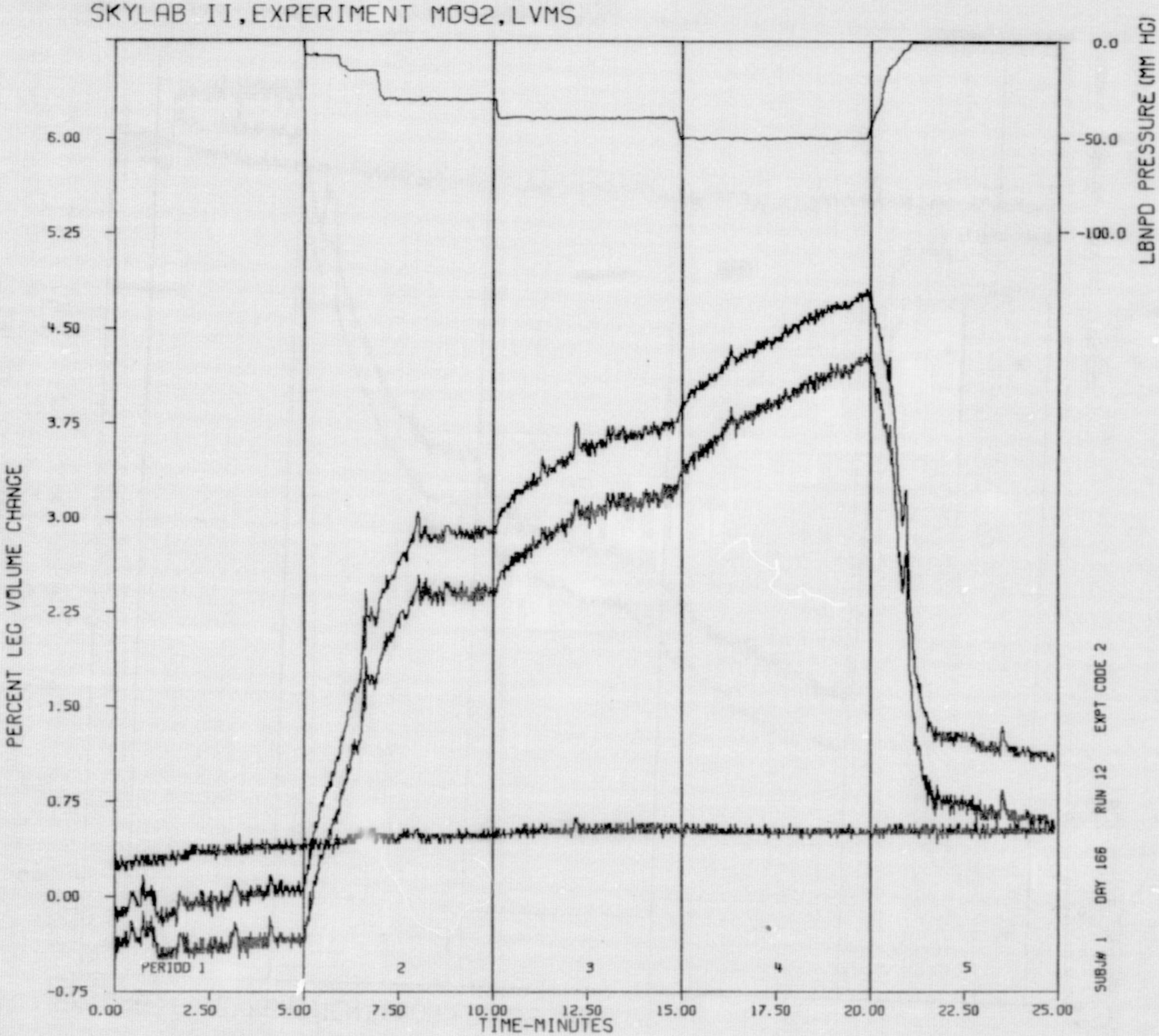
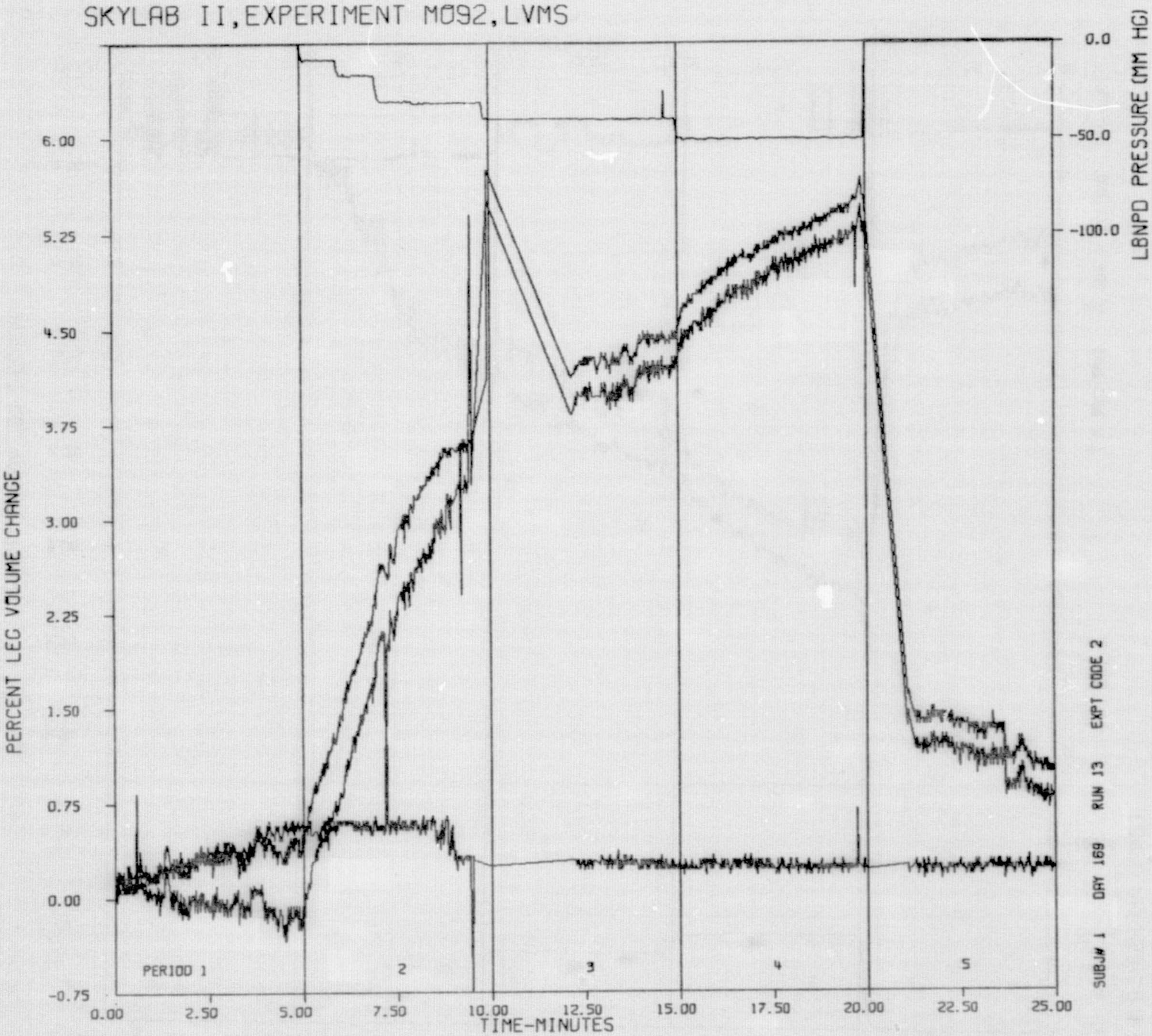
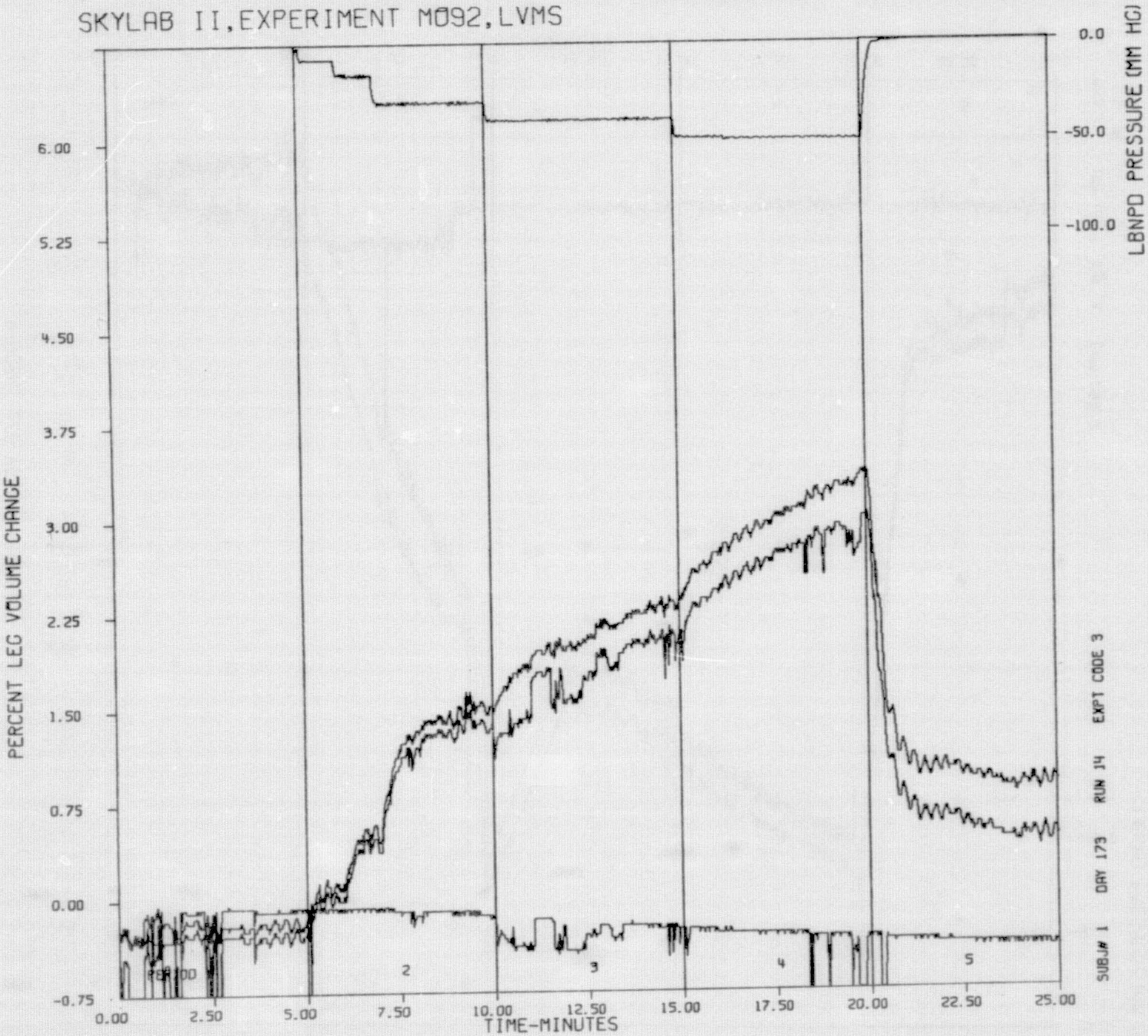
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
PERIOD 1
2
3
4
5
0.0
-50.0
-100.0
LBNPD PRESSURE (MM HG)
SUBJ# 1 DAY 163 RUN 11 EXPT CODE 2

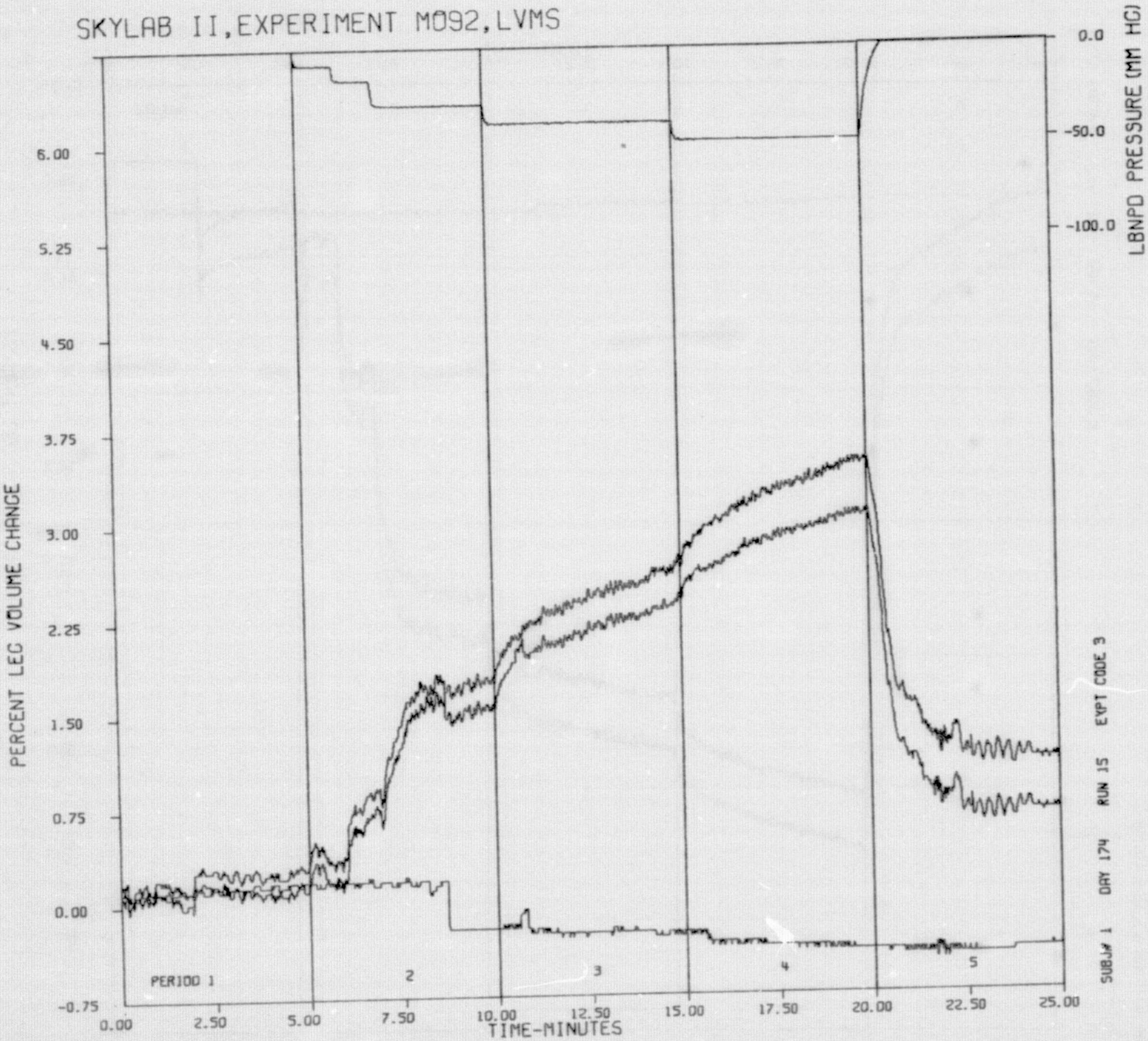
B-11

SKYLAB II, EXPERIMENT M092, LVMS



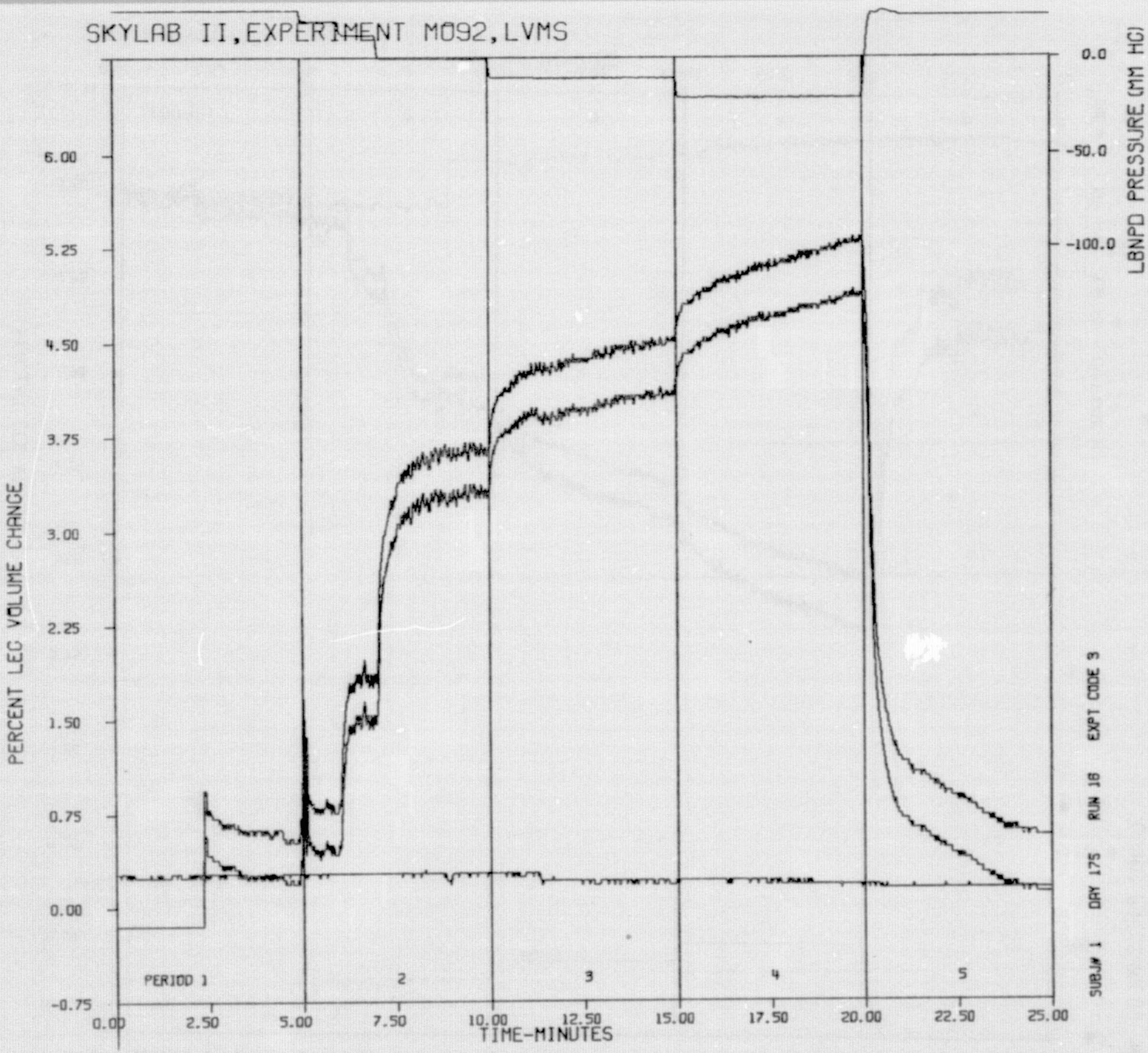

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 169 RUN 13 EXPT CODE 2


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD
2
3
4
5
SUBJ# 1 DAY 173 RUN 14 EXPT CODE 3

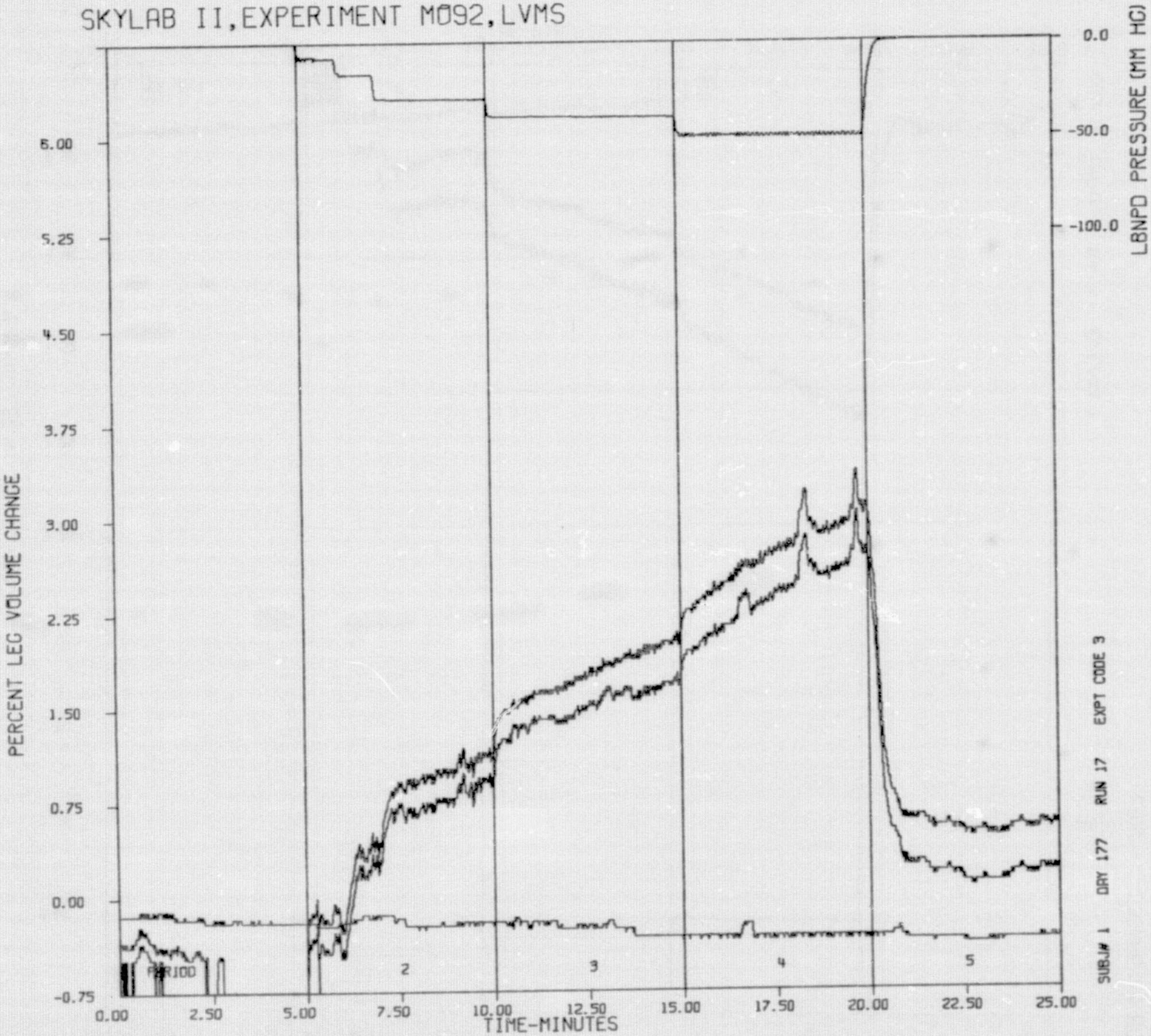


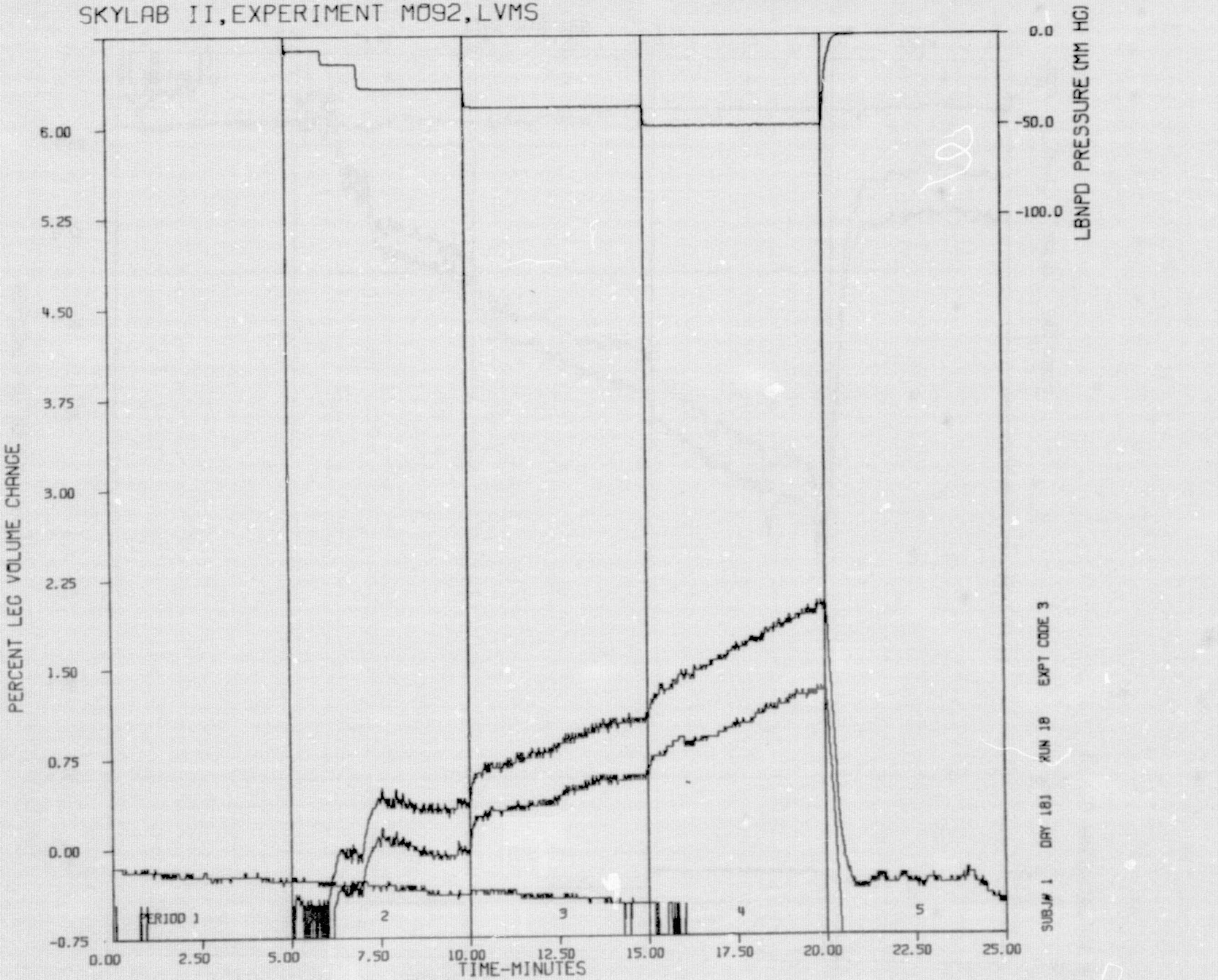
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
TIME-MINUTES
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 174 RUN 15 EXPT CODE 3

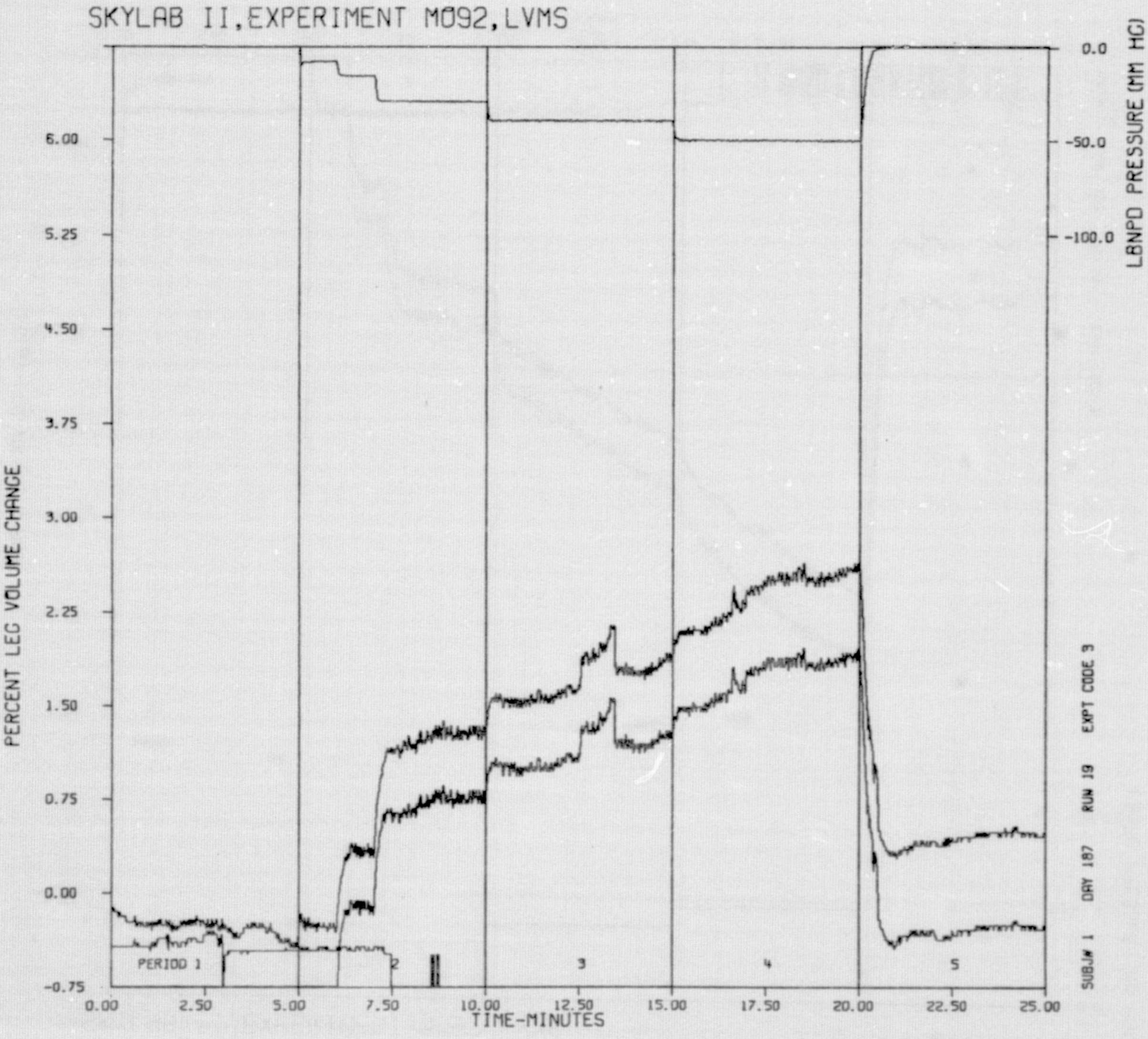
B-15



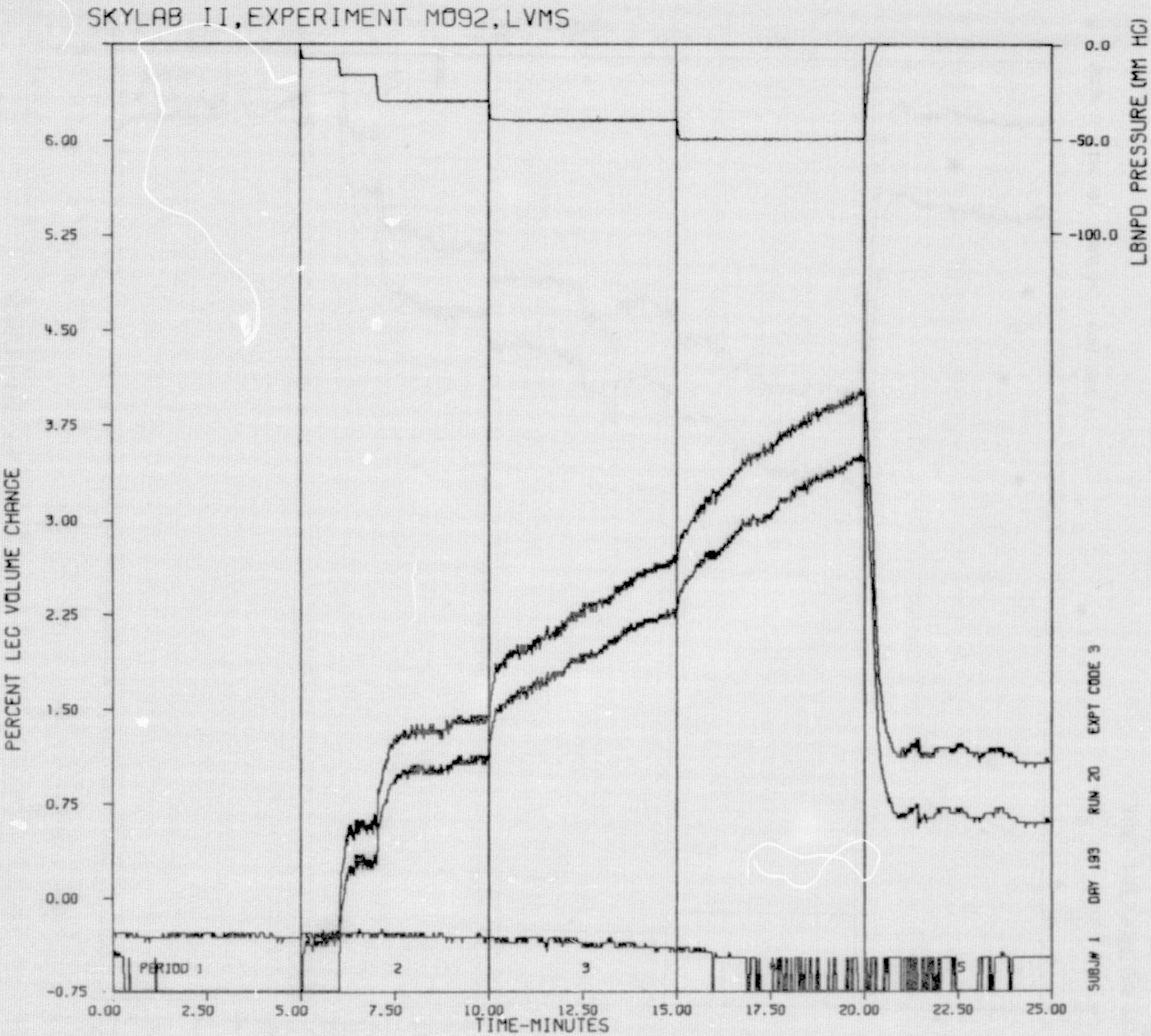
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 175 RUN 18 EXPT CODE 3


SKYLAB II,EXPERIMENT M092,LVMS
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
PERIOD
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
SUBJ# 1 DAY 177 RUN 17 EXPT CODE 3

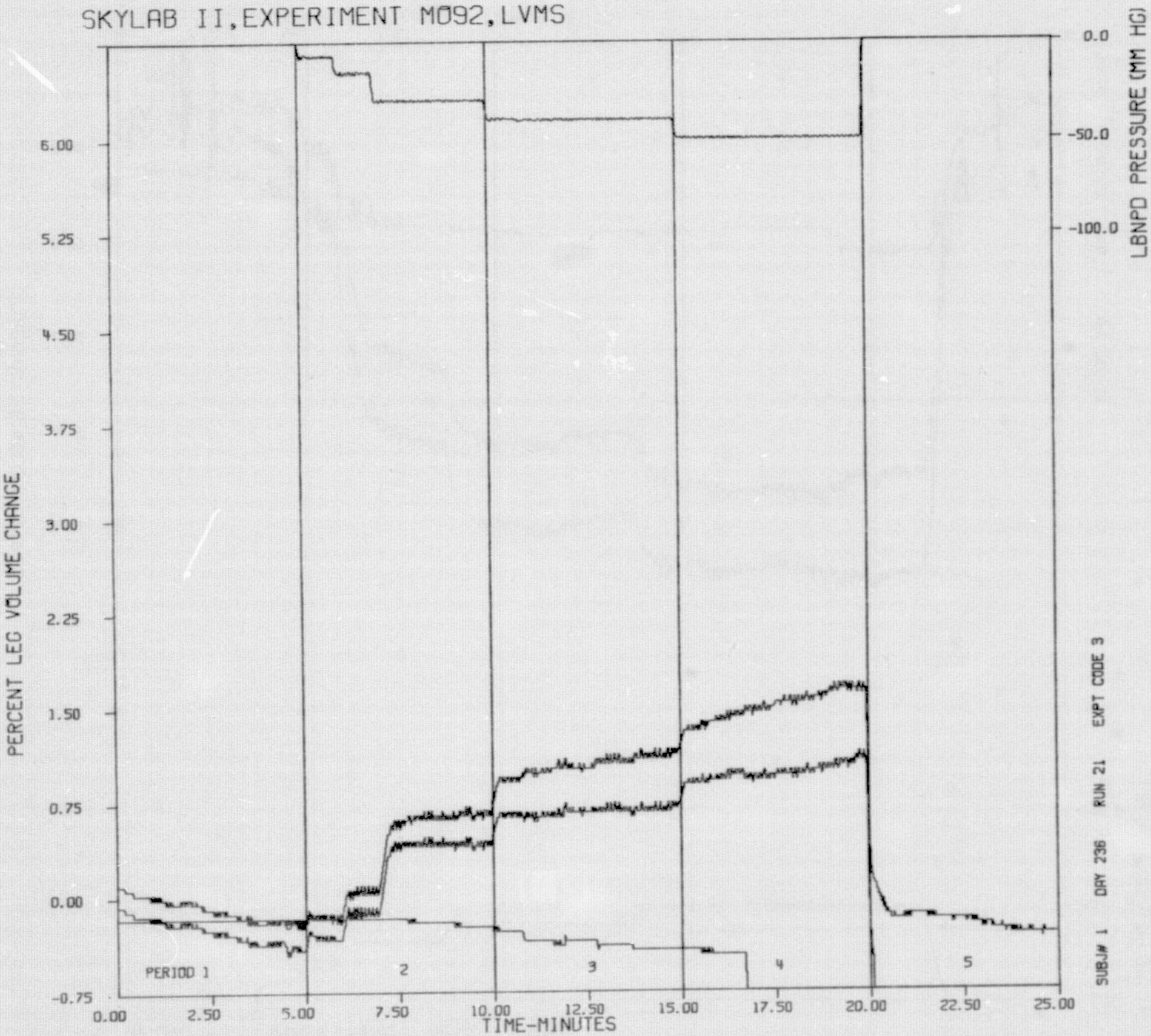

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 181 XUN 18 EXPT CODE 3

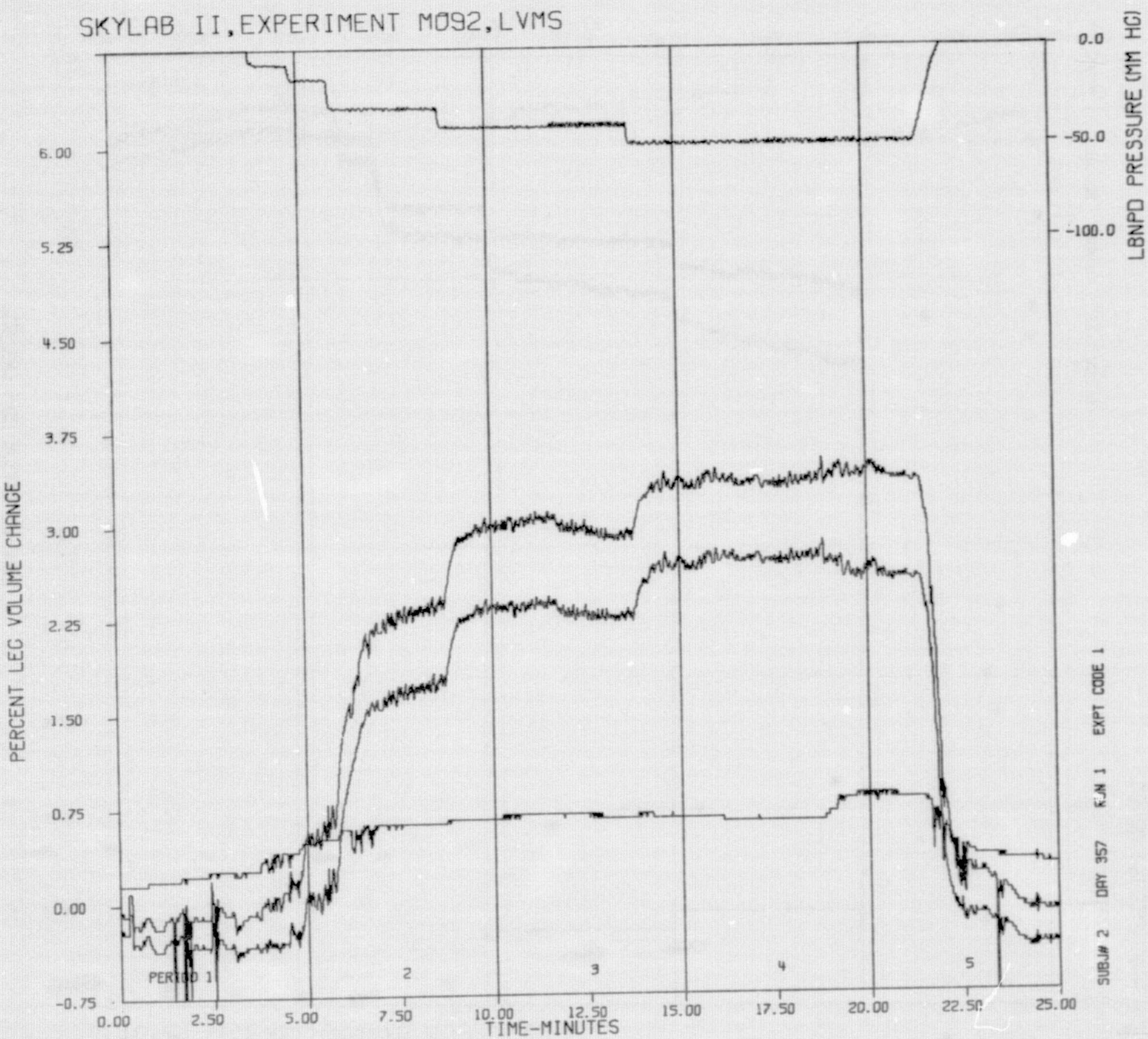


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 187 RUN 19 EXPT CODE 3

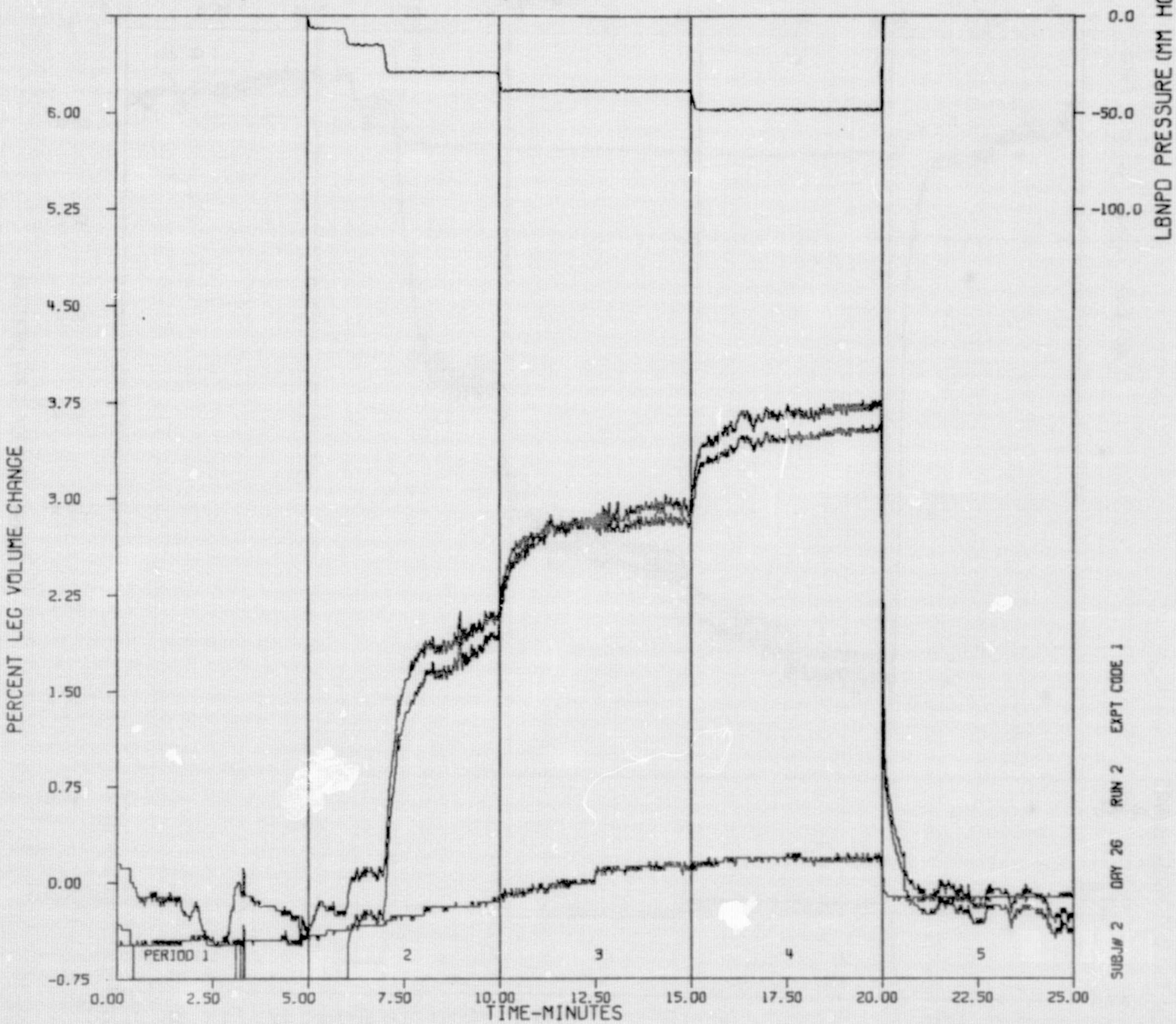

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
5
SUBJ# 1 DAY 193 RUN 20 EXPT CODE 3

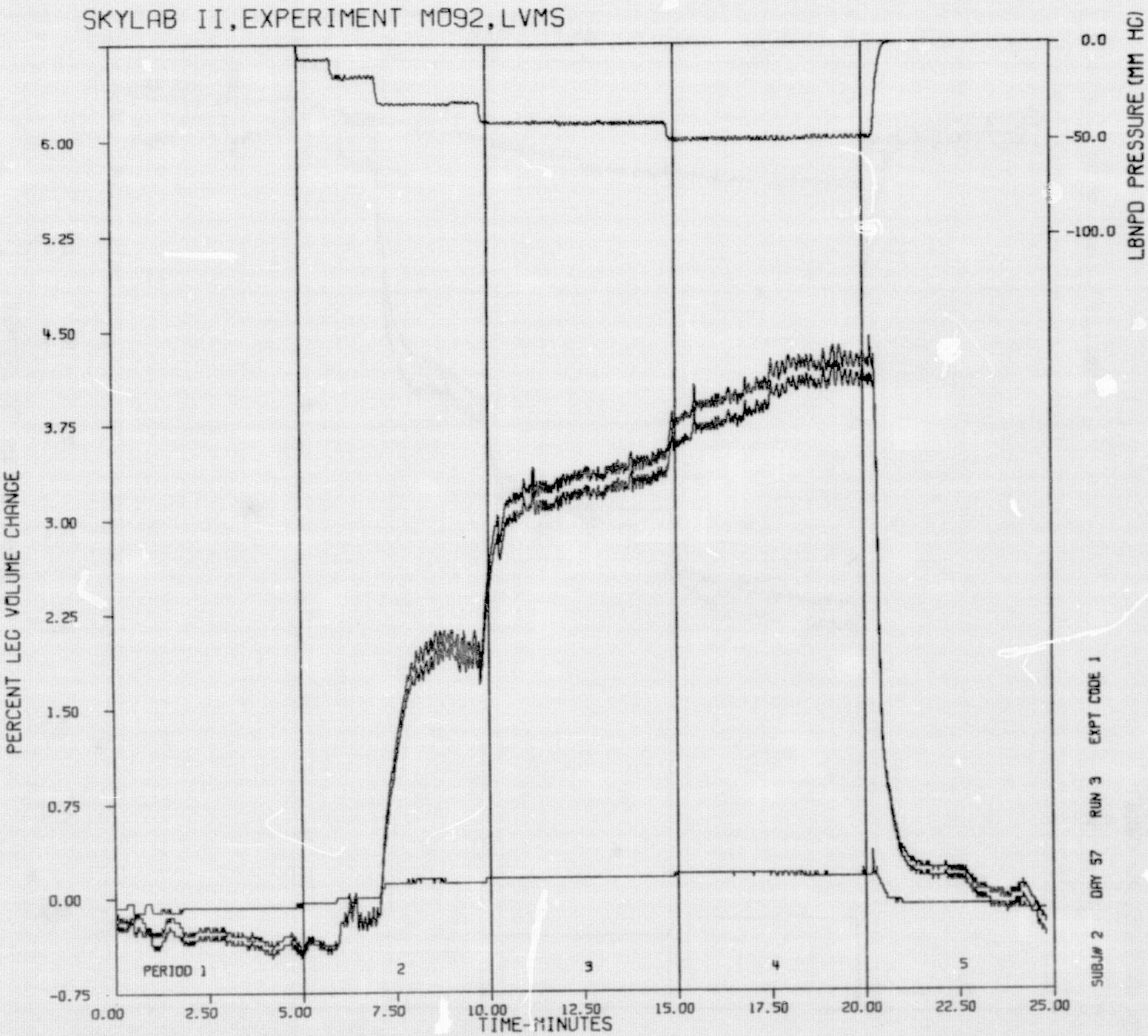
B-20


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 236 RUN 21 EXPT CODE 3
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00

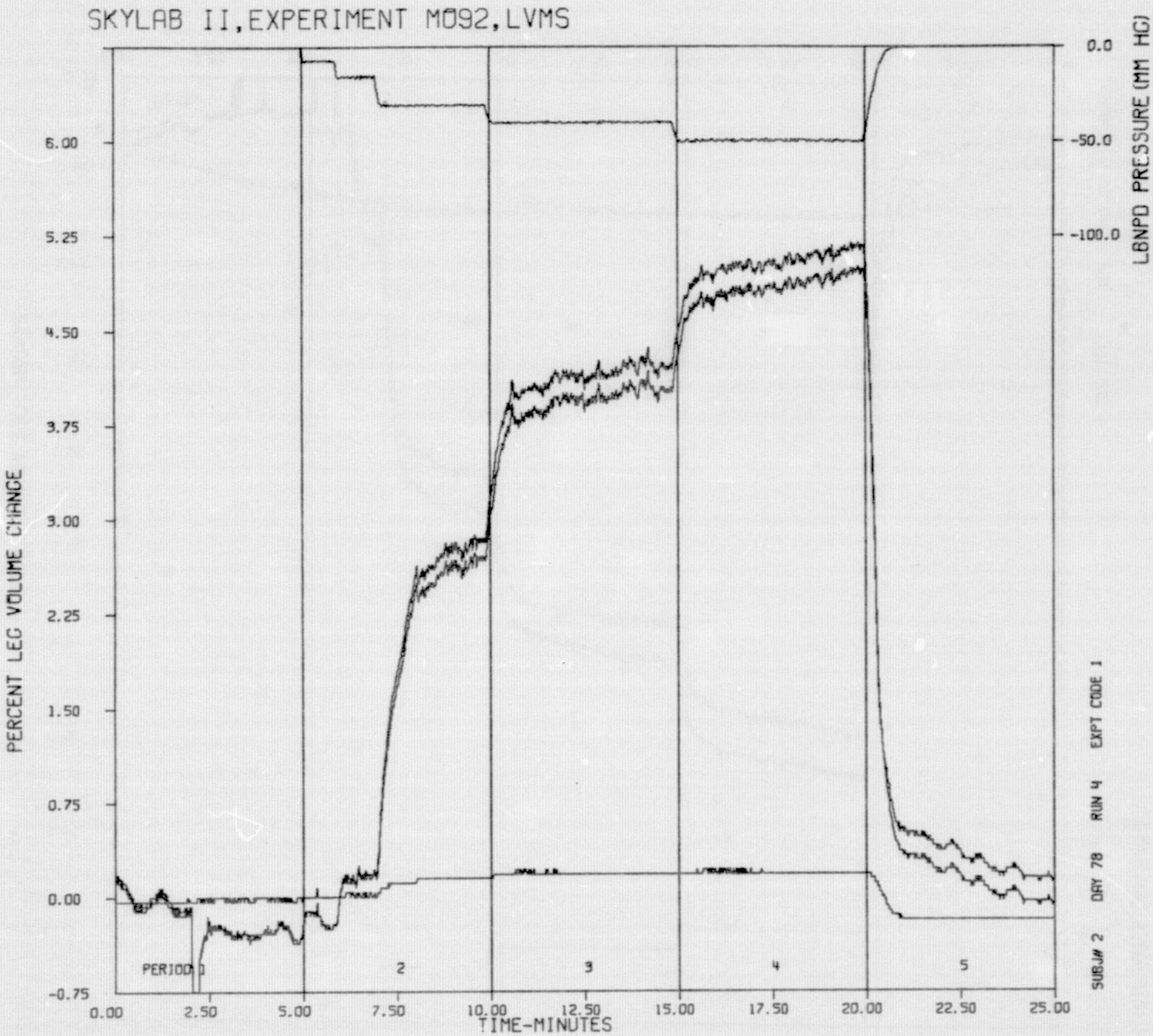

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 357 RUN 1 EXPT CODE 1

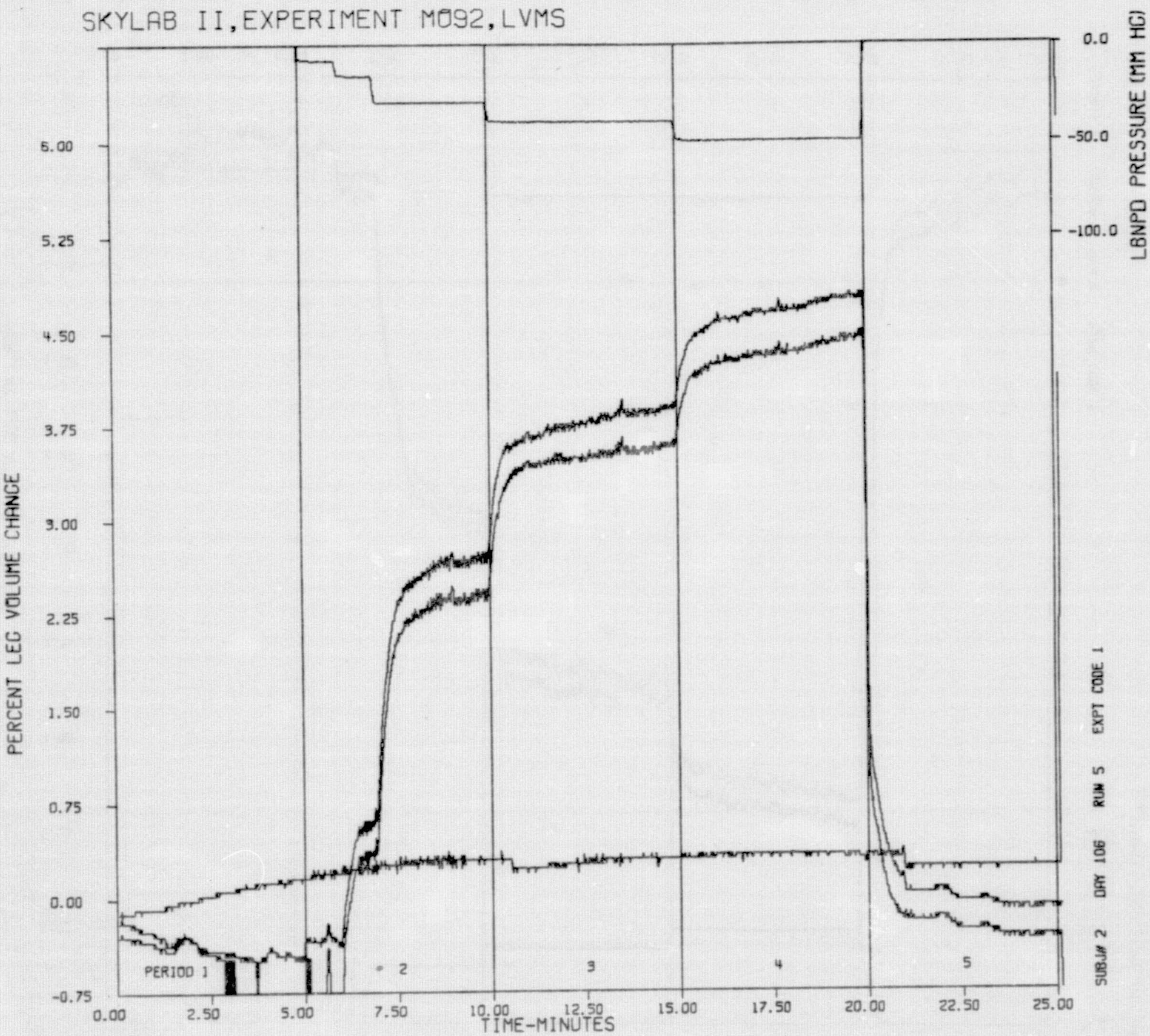
SKYLAB II, EXPERIMENT M092, LVMS

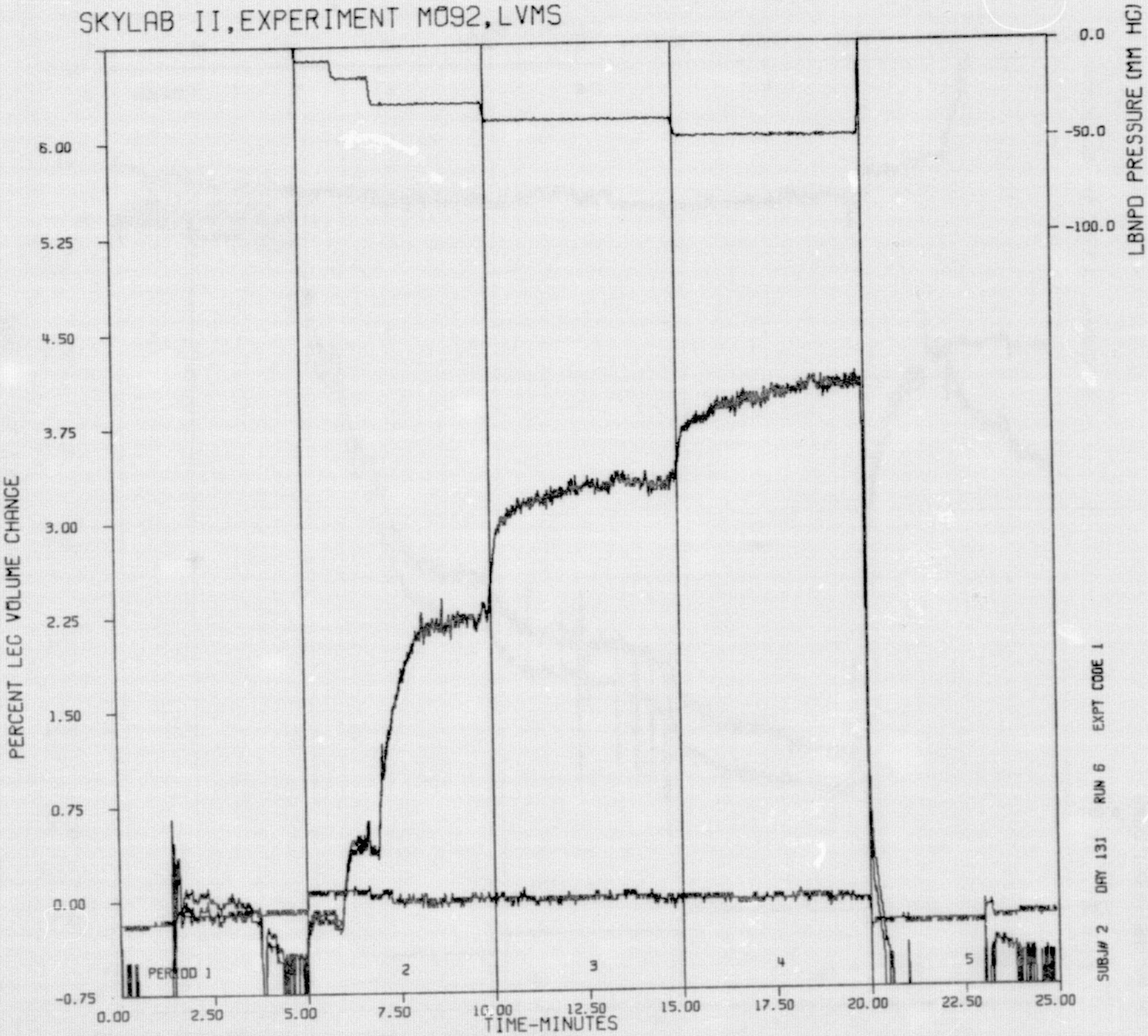




SKYLAB II,EXPERIMENT M092,LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 57 RUN 3 EXPT CODE 1

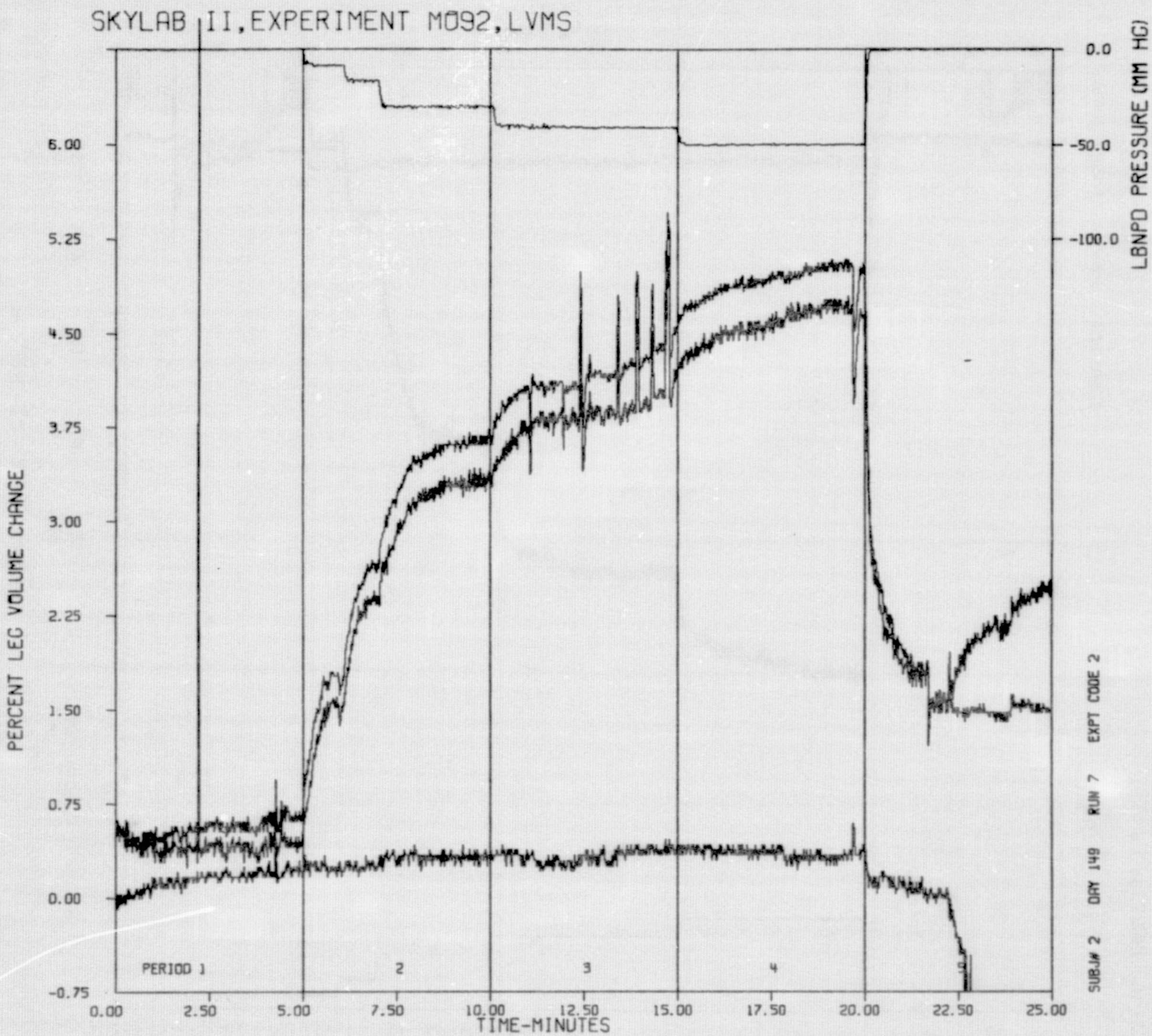

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
SUBJ# 2 DAY 78 RUN 4 EXPT CODE 1


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
TIME-MINUTES
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 106 RUN 5 EXPT CODE 1

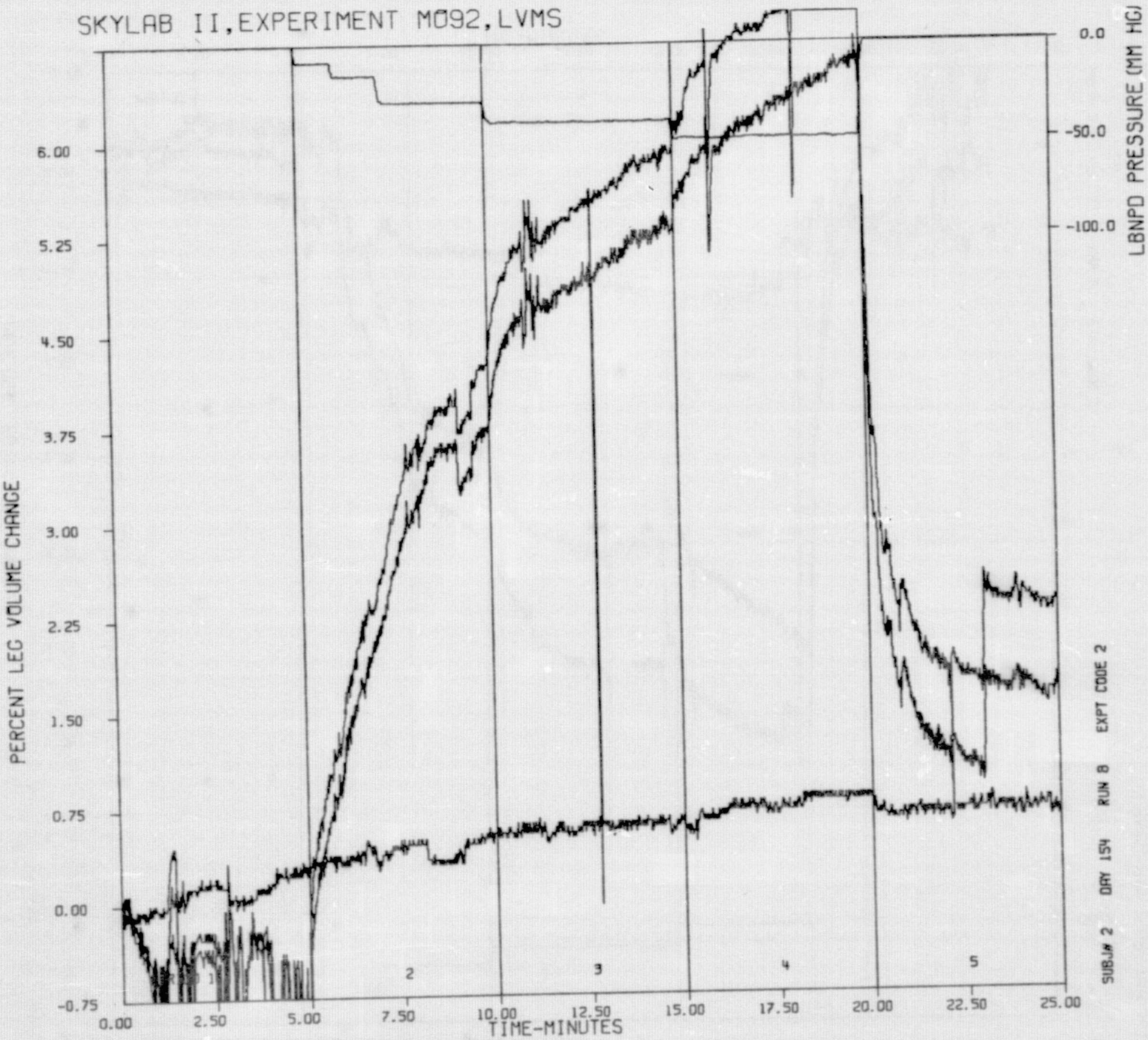


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 131 RUN 6 EXPT CODE 1
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00

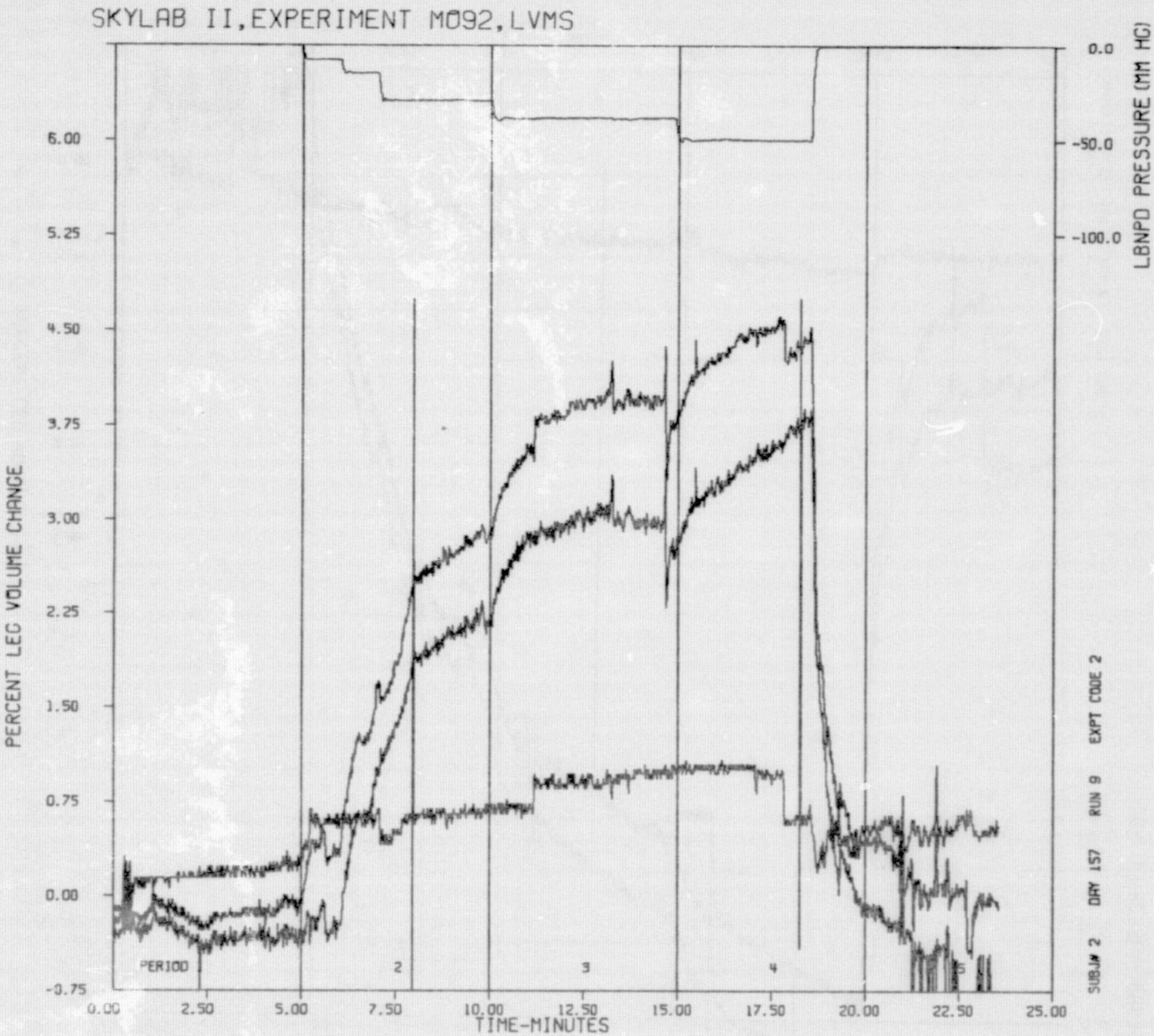
B-27



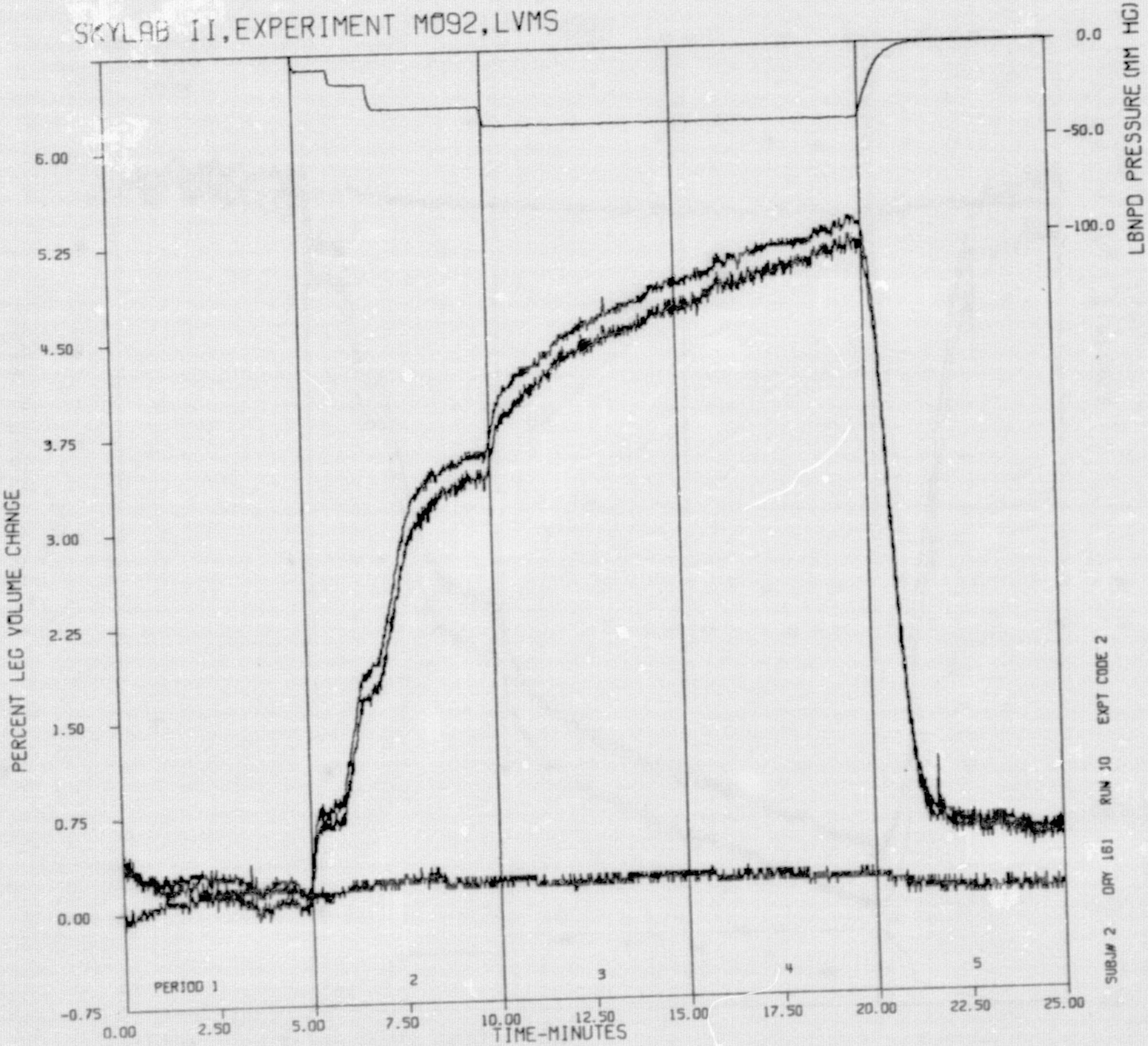
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
PERIOD 1
2
3
4
5
0.0
-50.0
-100.0
LBNPD PRESSURE (MM HG)
SUBJ# 2   DAY 149   RUN 7   EXPT CODE 2


SKYLAB II, EXPERIMENT MØ92, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
1
2
3
4
5
SUBJ# 2 DAY 154 RUN 8 EXPT CODE 2

8-29

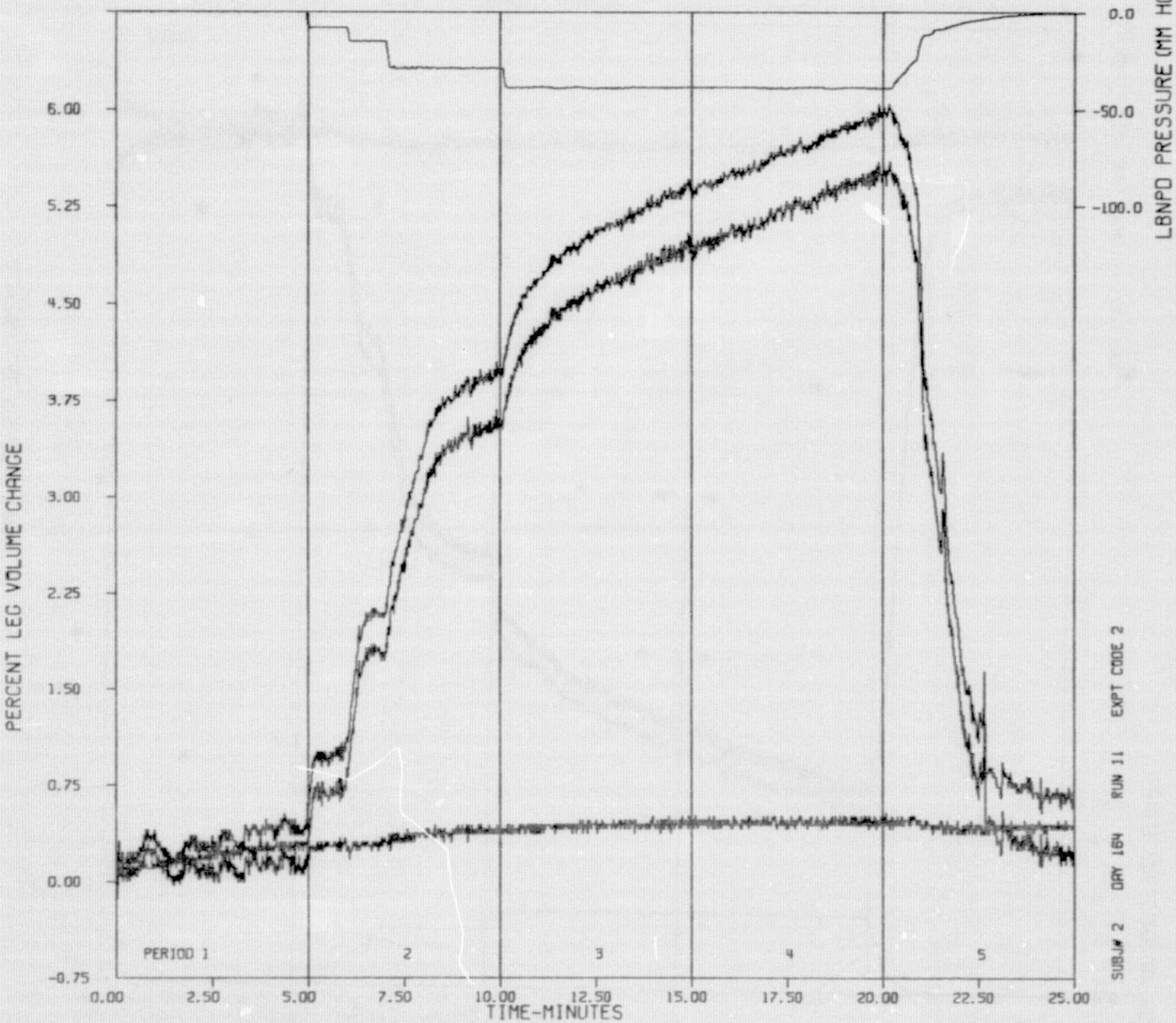


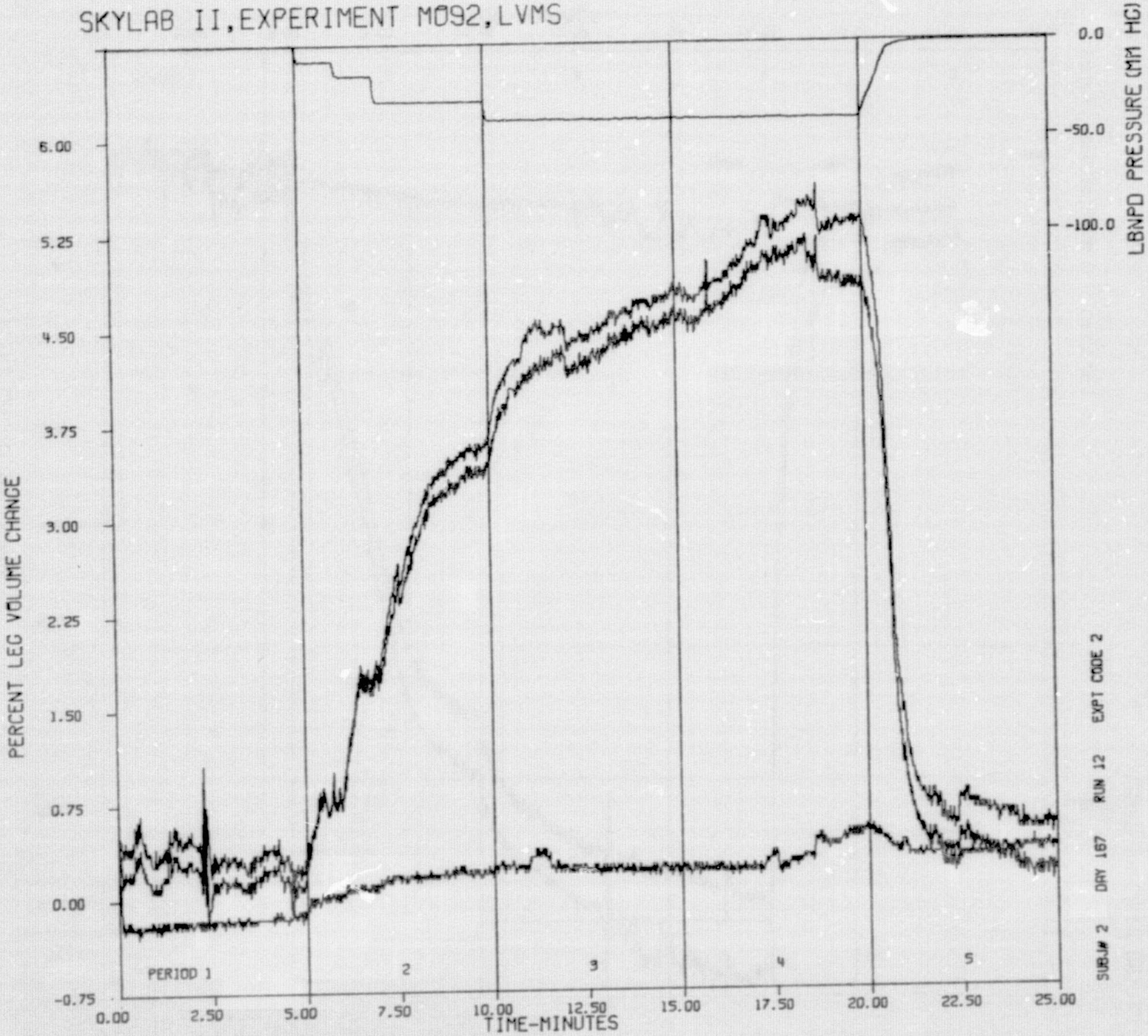
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERIOD
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
SUBJ# 2
DAY 157
RUN 9
EXPT CODE 2



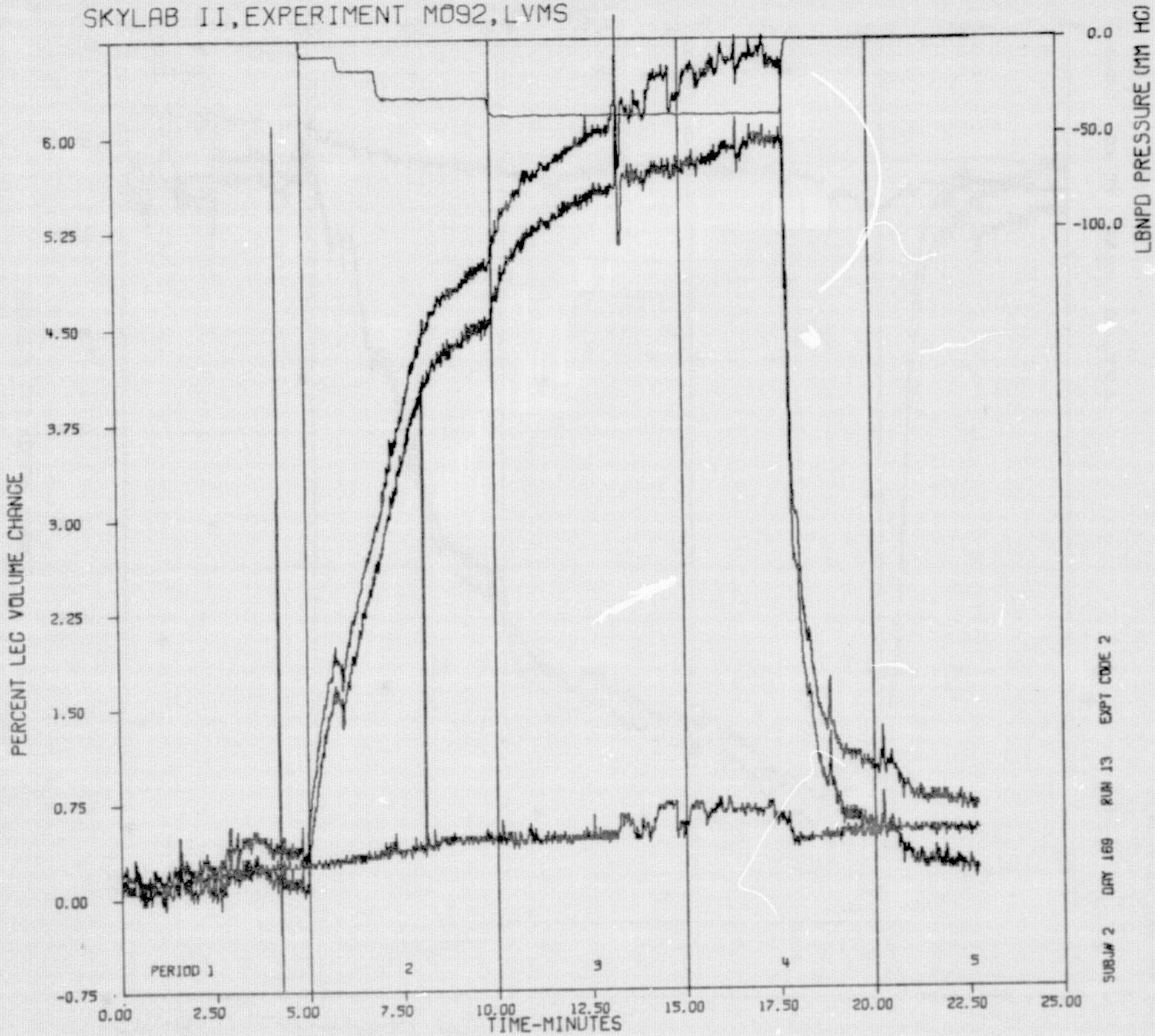
SKYLAB II, EXPERIMENT MØ92, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 161 RUN 10 EXPT CODE 2

SKYLAB II, EXPERIMENT MØ92, LVMS

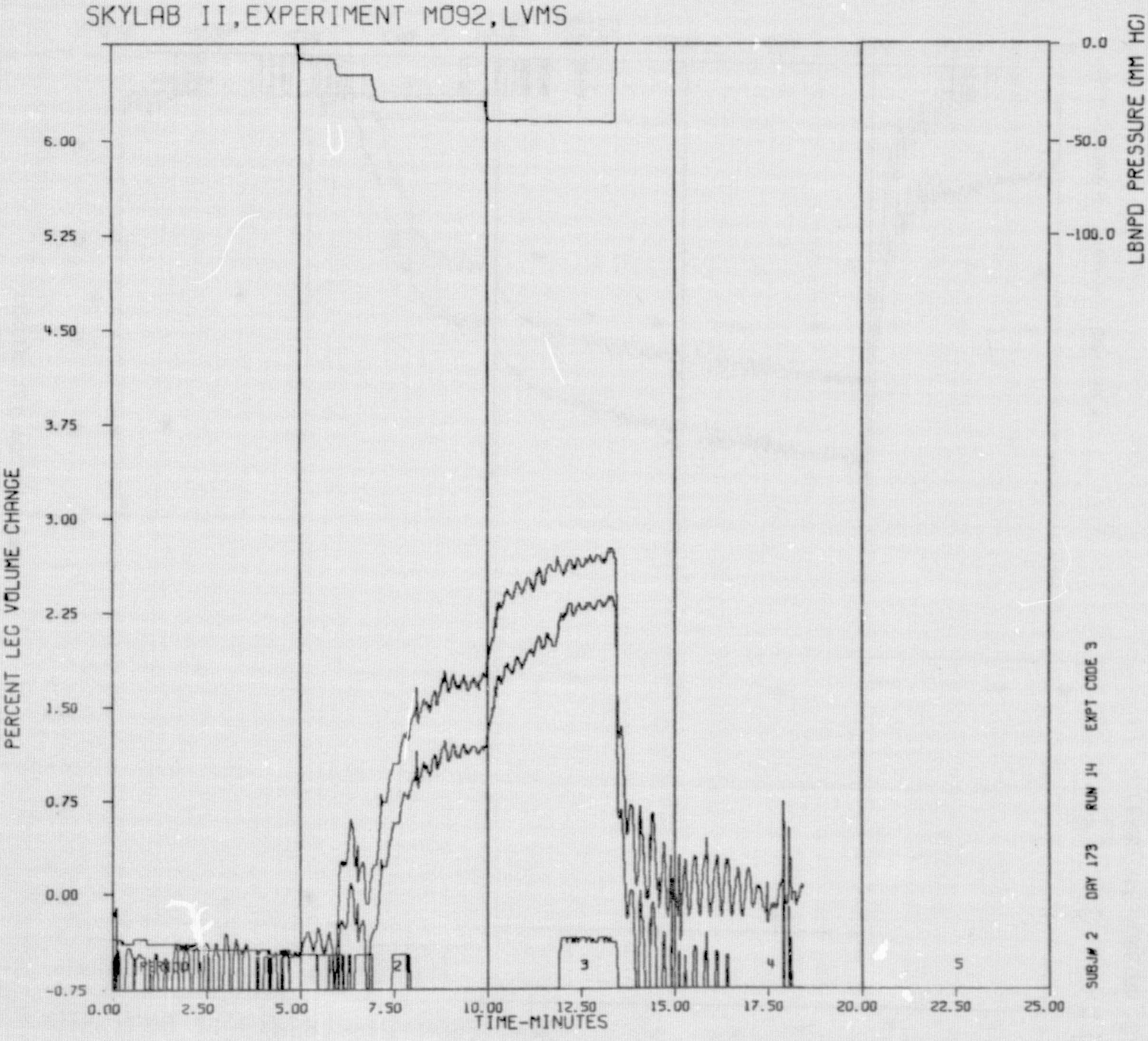




SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 167 RUN 12 EXPT CODE 2

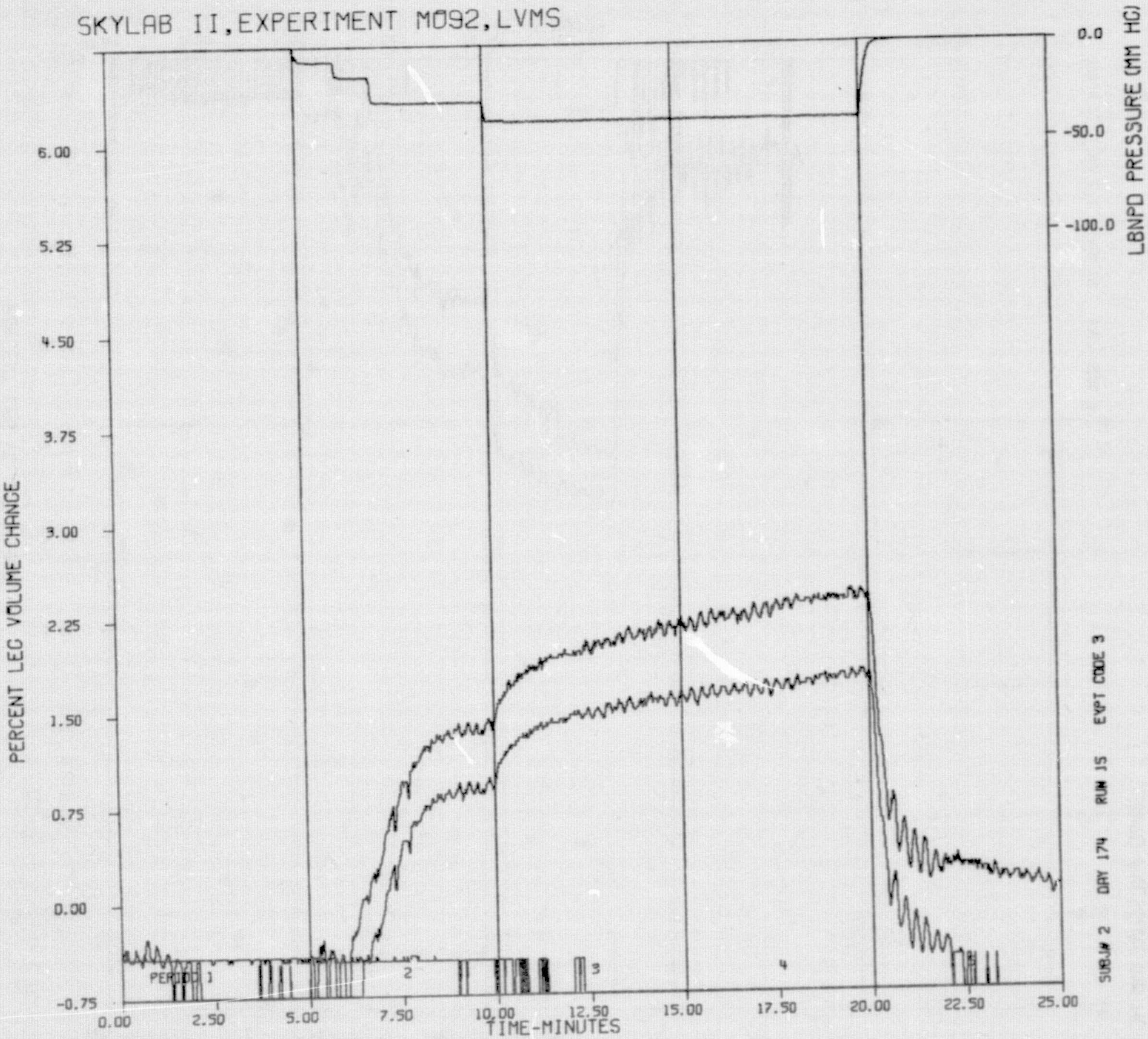


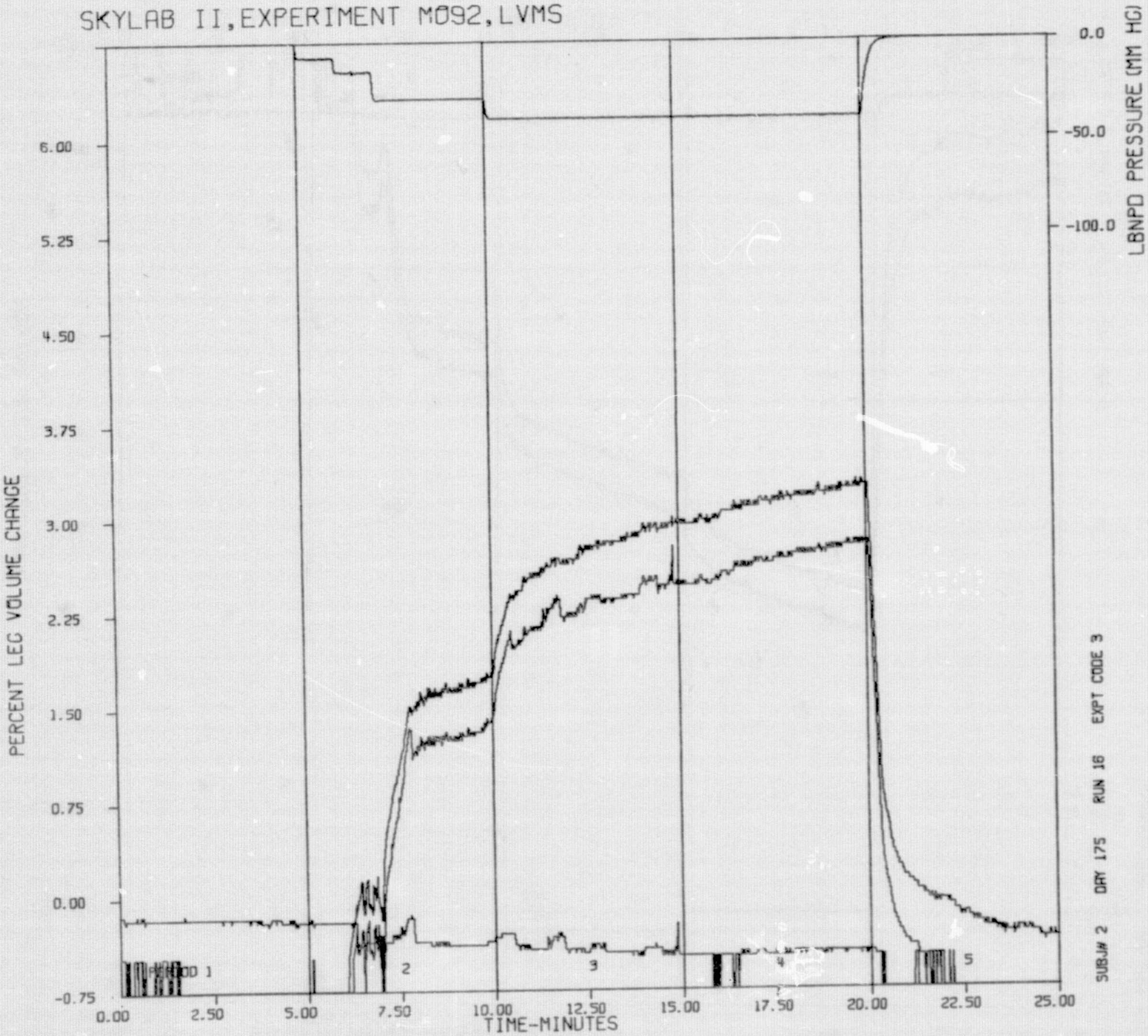
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 169 RUN 13 EXPT CODE 2



SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 173 RUN 14 EXPT CODE 3

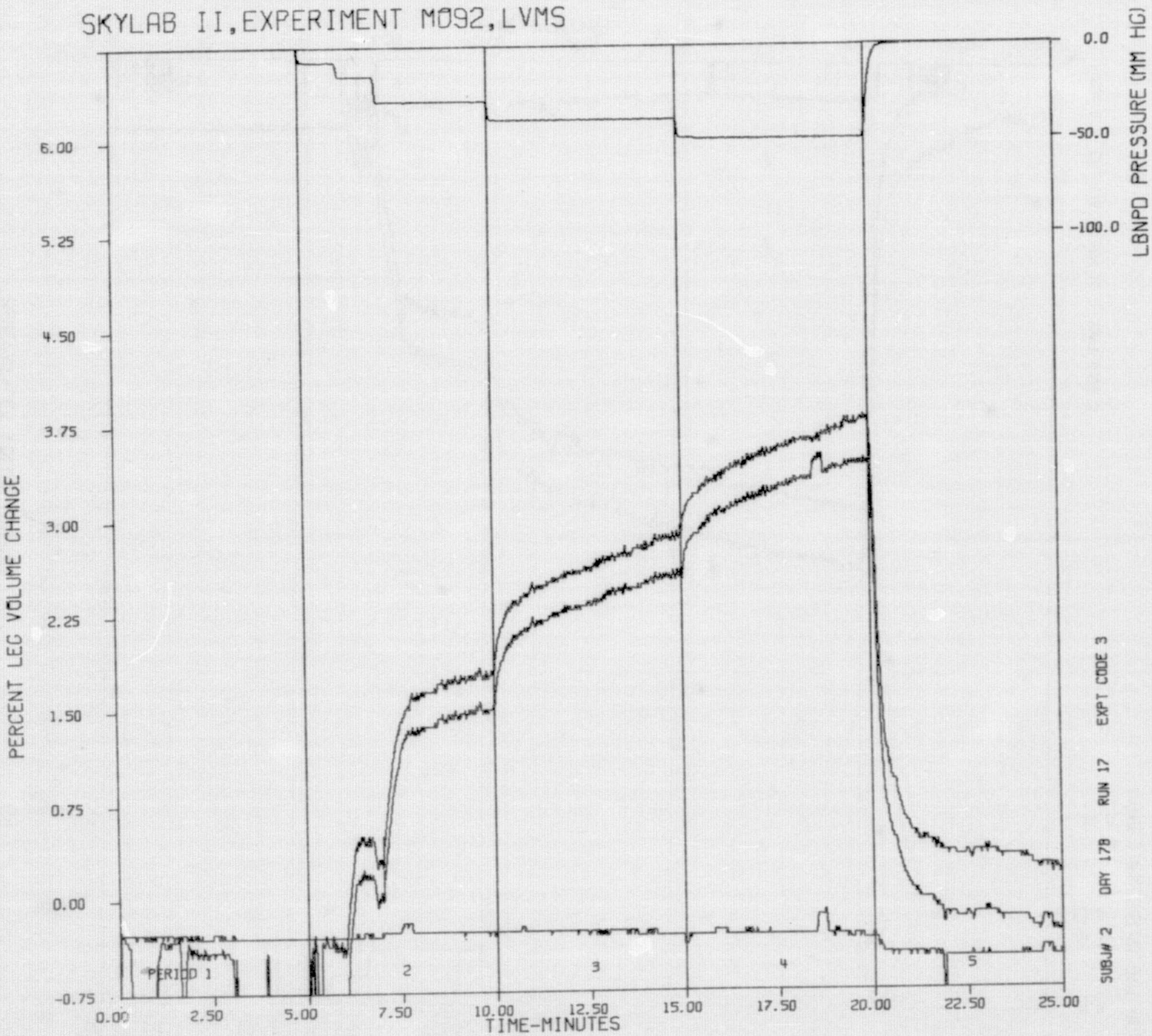
B-35

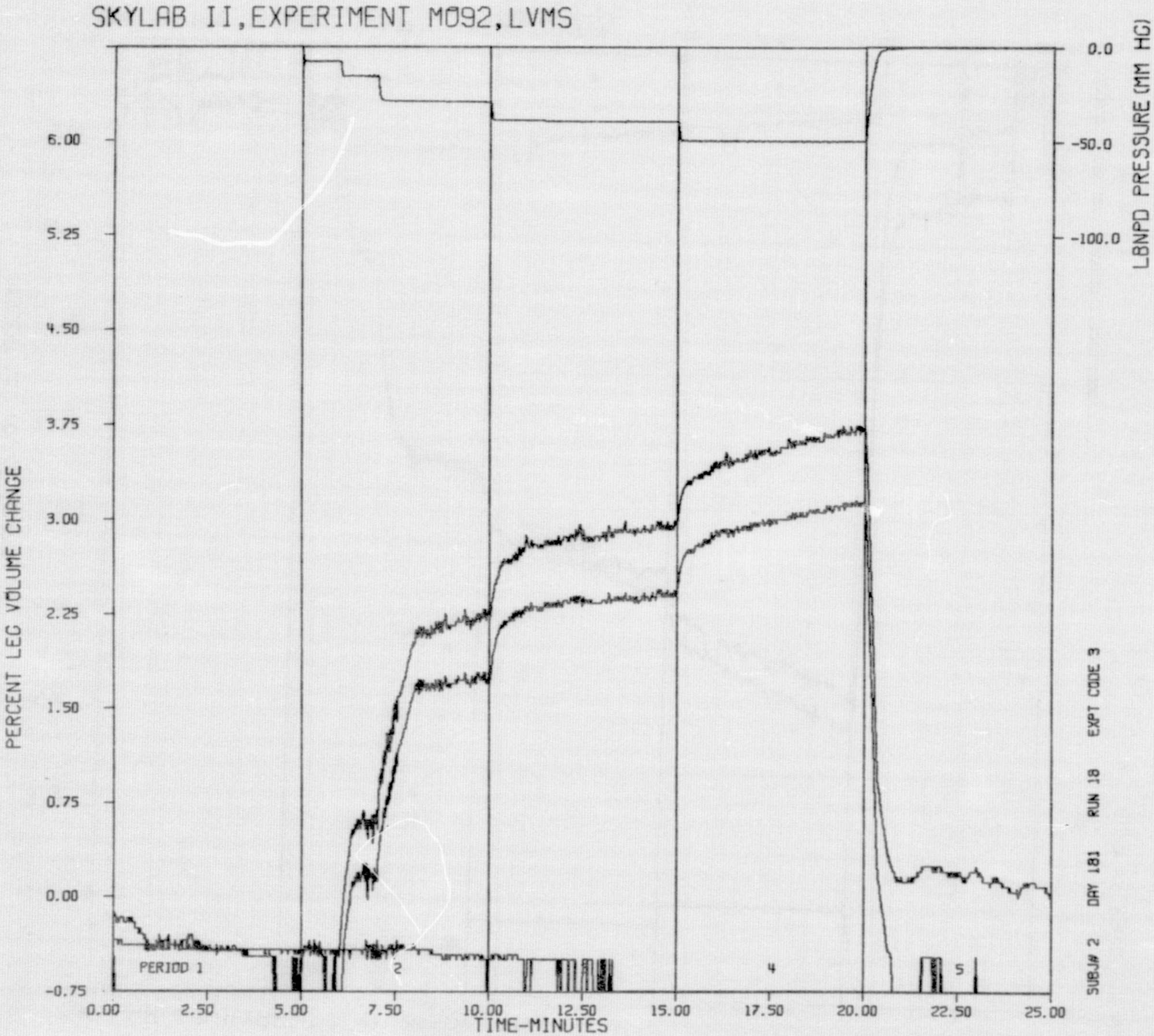

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
TIME-MINUTES
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
SUBJ# 2 DAY 174 RUN 15 EXPT CODE 3



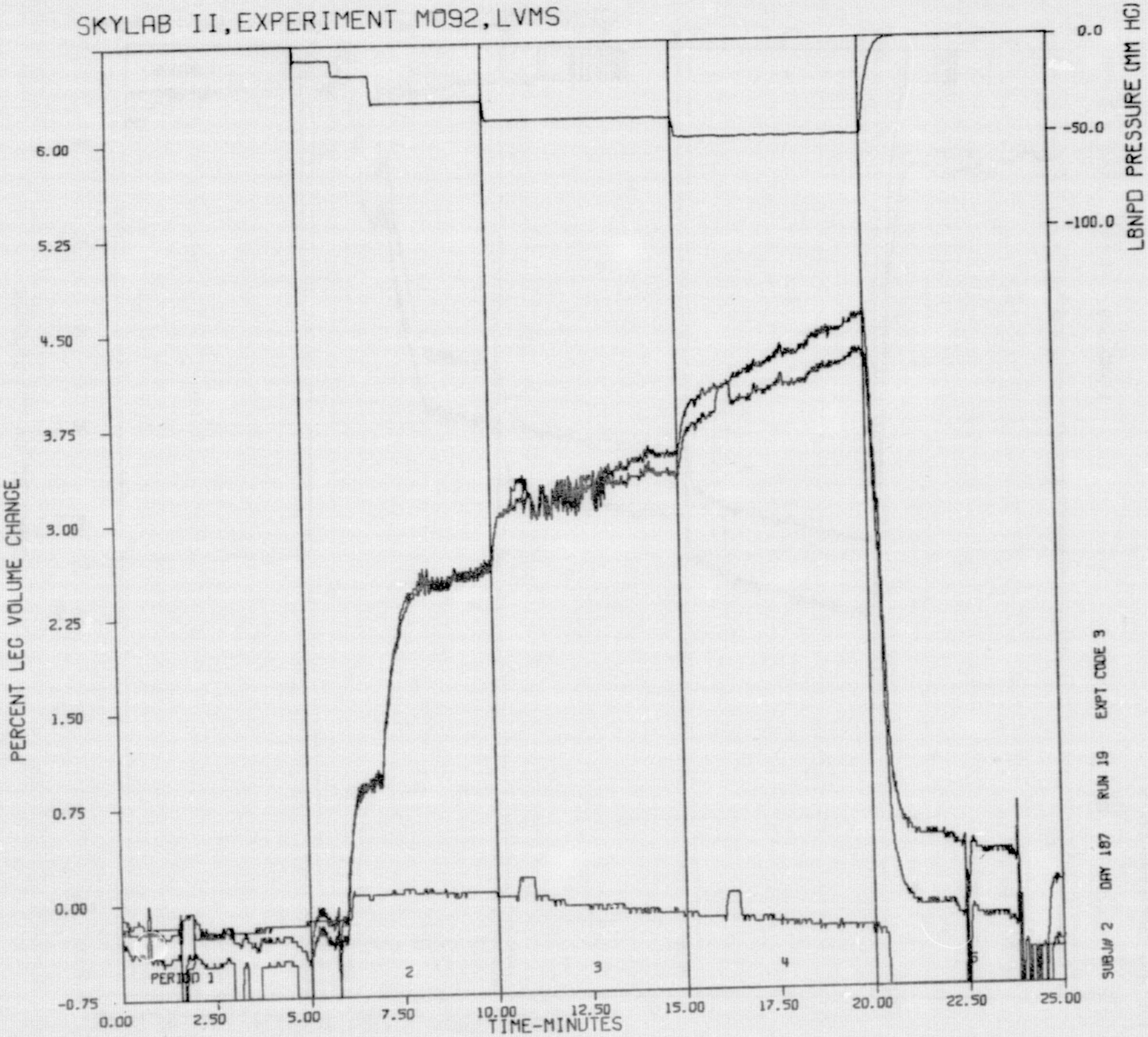
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 175 RUN 16 EXPT CODE 3

B-37


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
EXPT CODE 3
RUN 17
DAY 178
SUBJ# 2

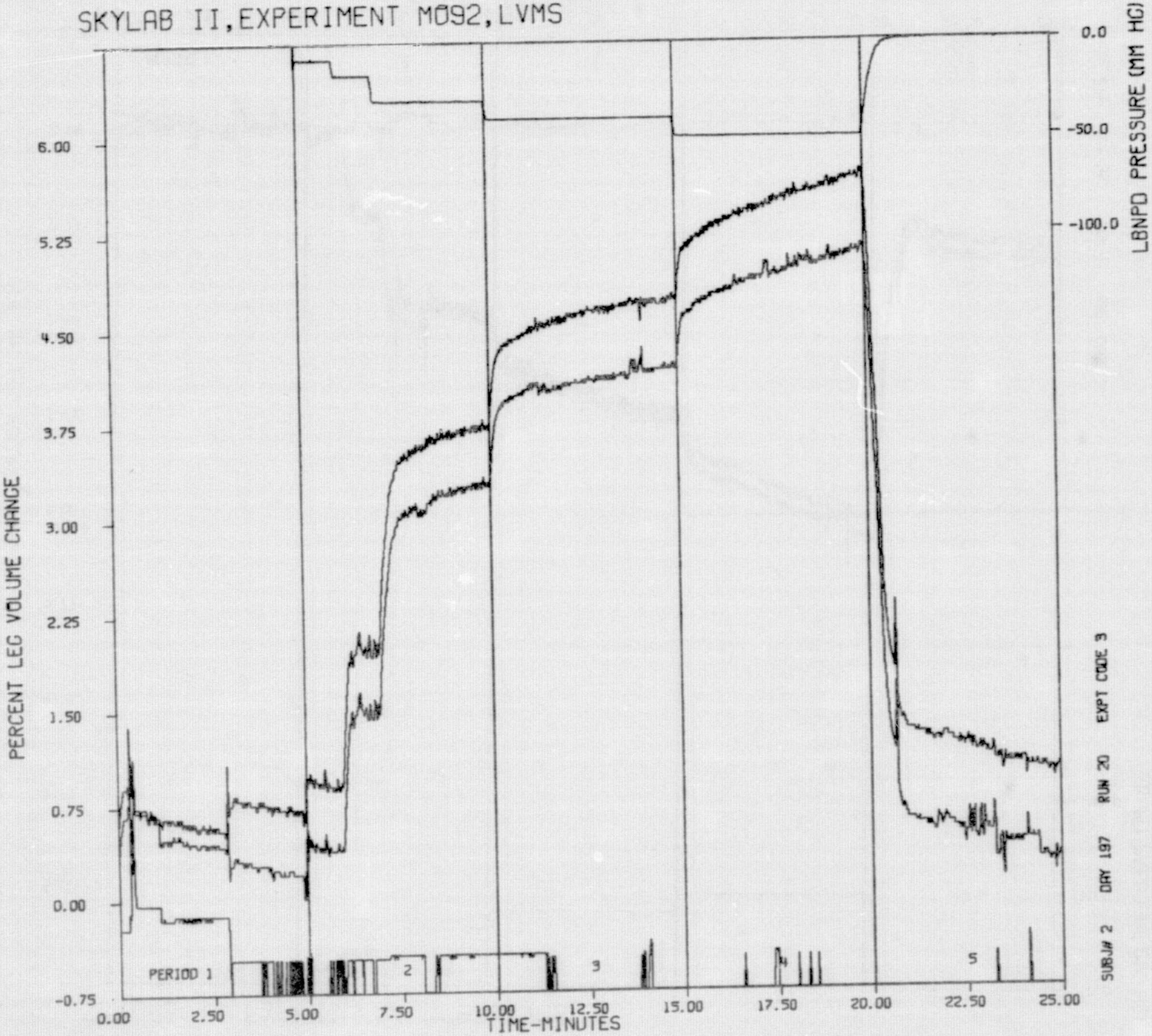


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
0.0
-50.0
-100.0
LBNPD PRESSURE (MM HG)
PERIOD 1
2
4
5
SUBJ# 2 DAY 181 RUN 18 EXPT CODE 3

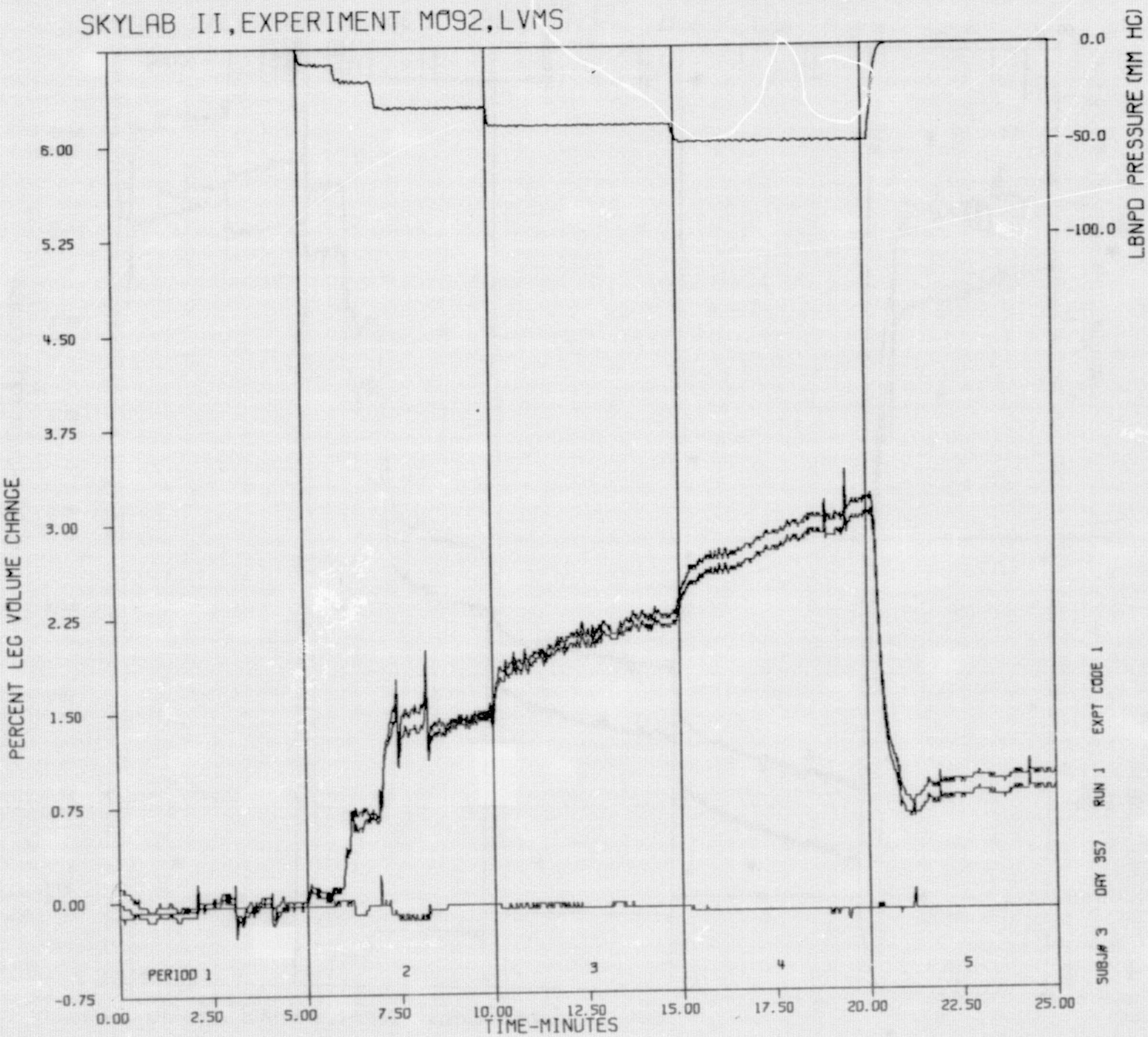


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
0.0
-50.0
-100.0
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 187 RUN 19 EXPT CODE 3

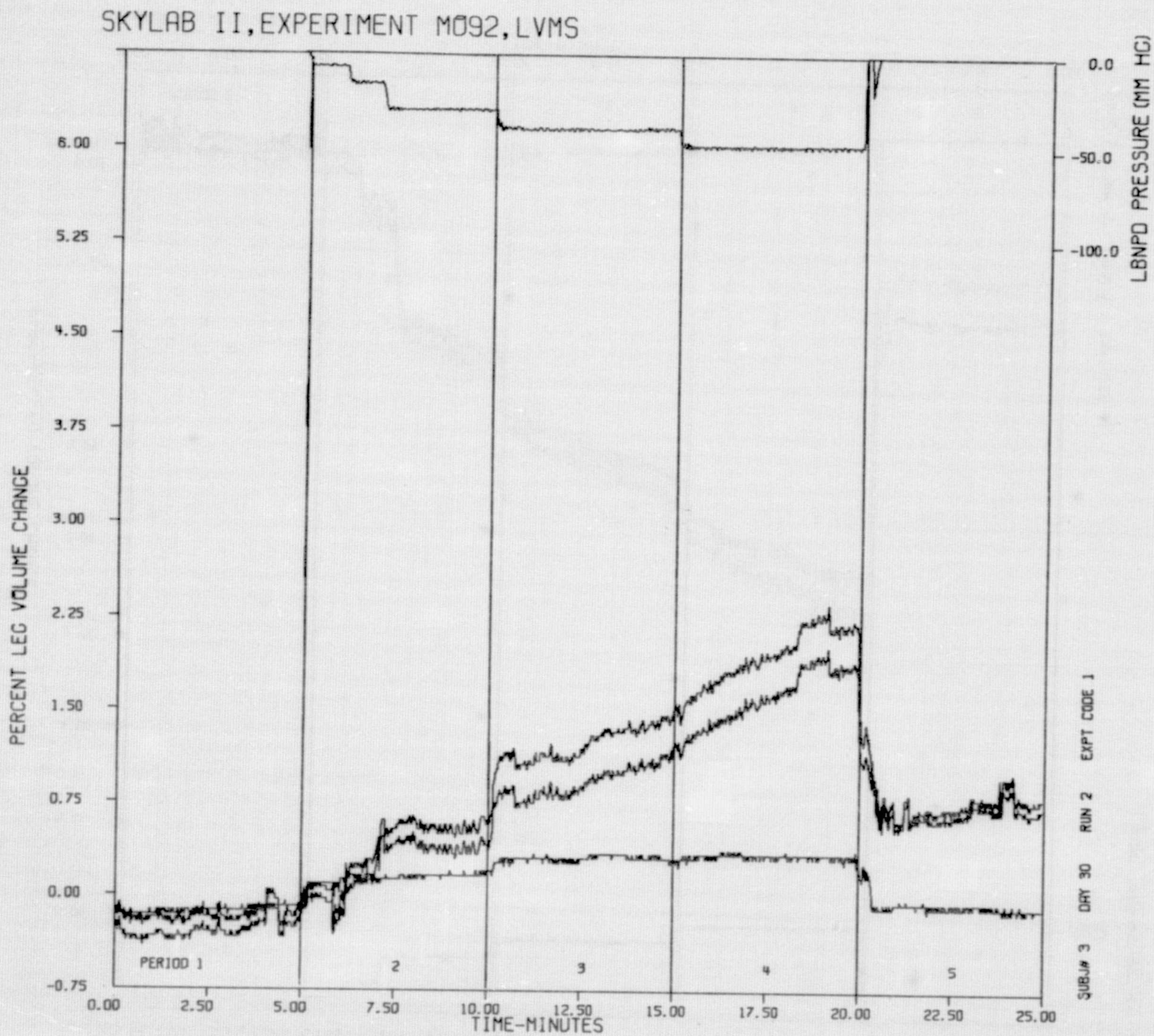
B-40


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2
DAY 197
RUN 20
EXPT CODE 3

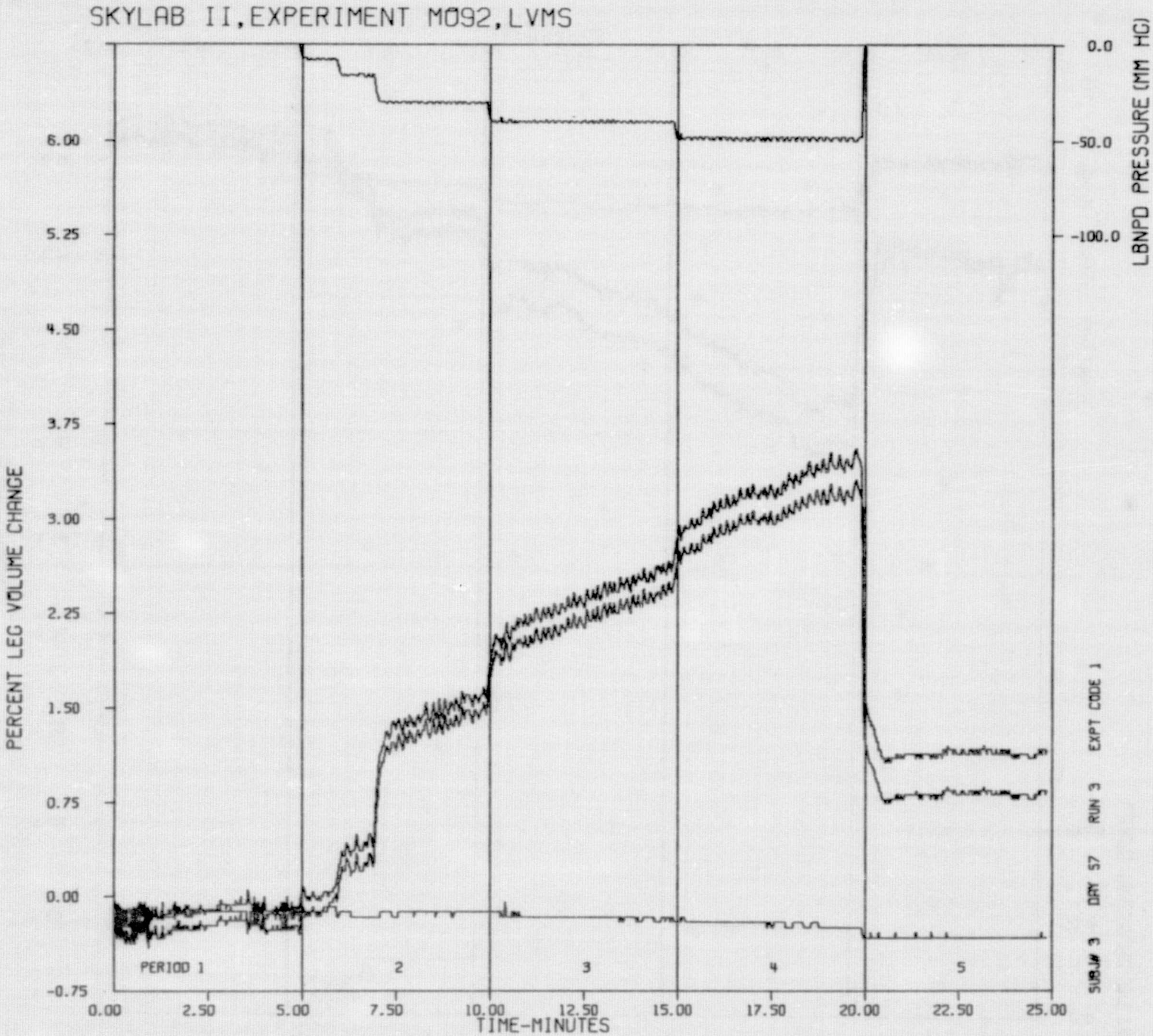
B-41



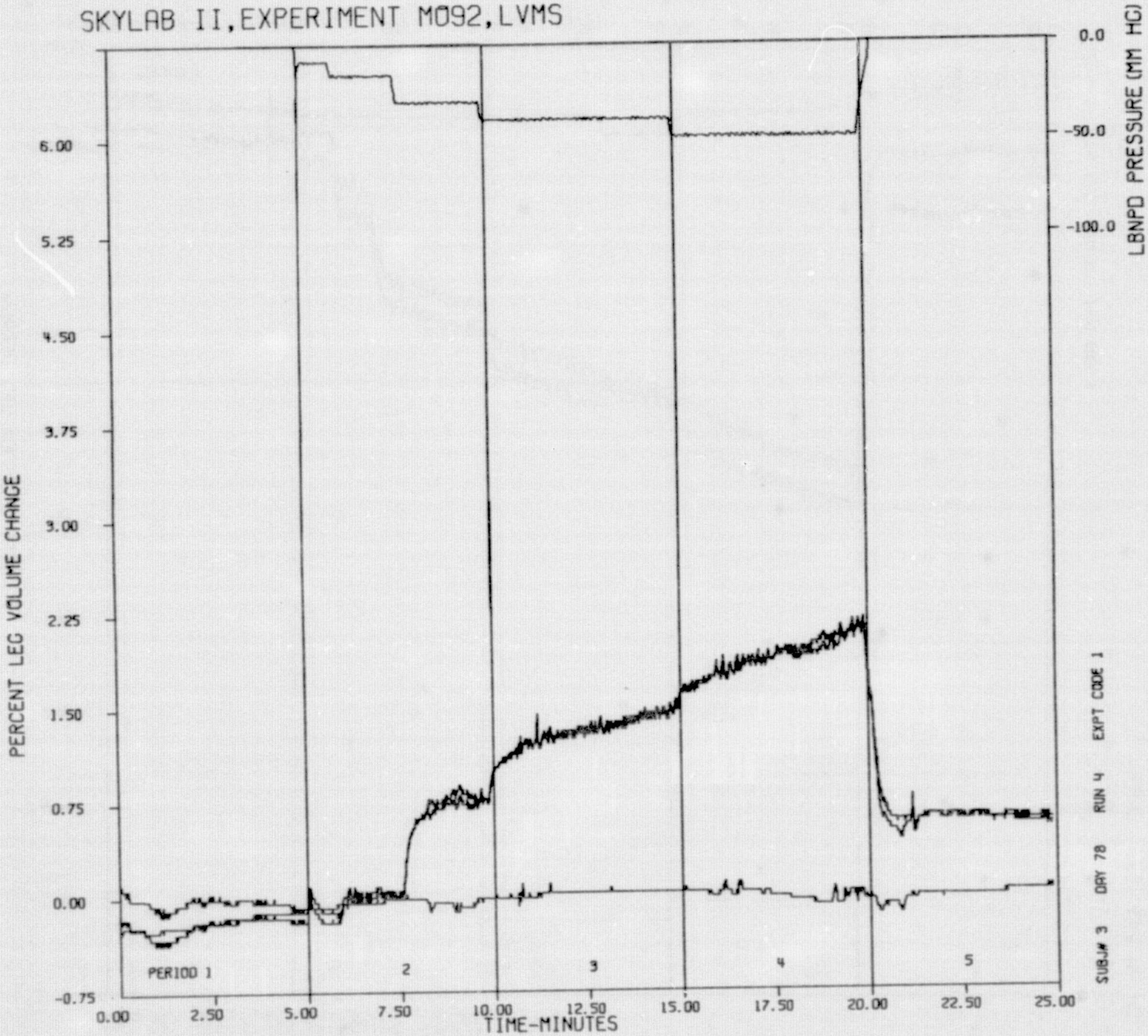
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 357 RUN 1 EXPT CODE 1

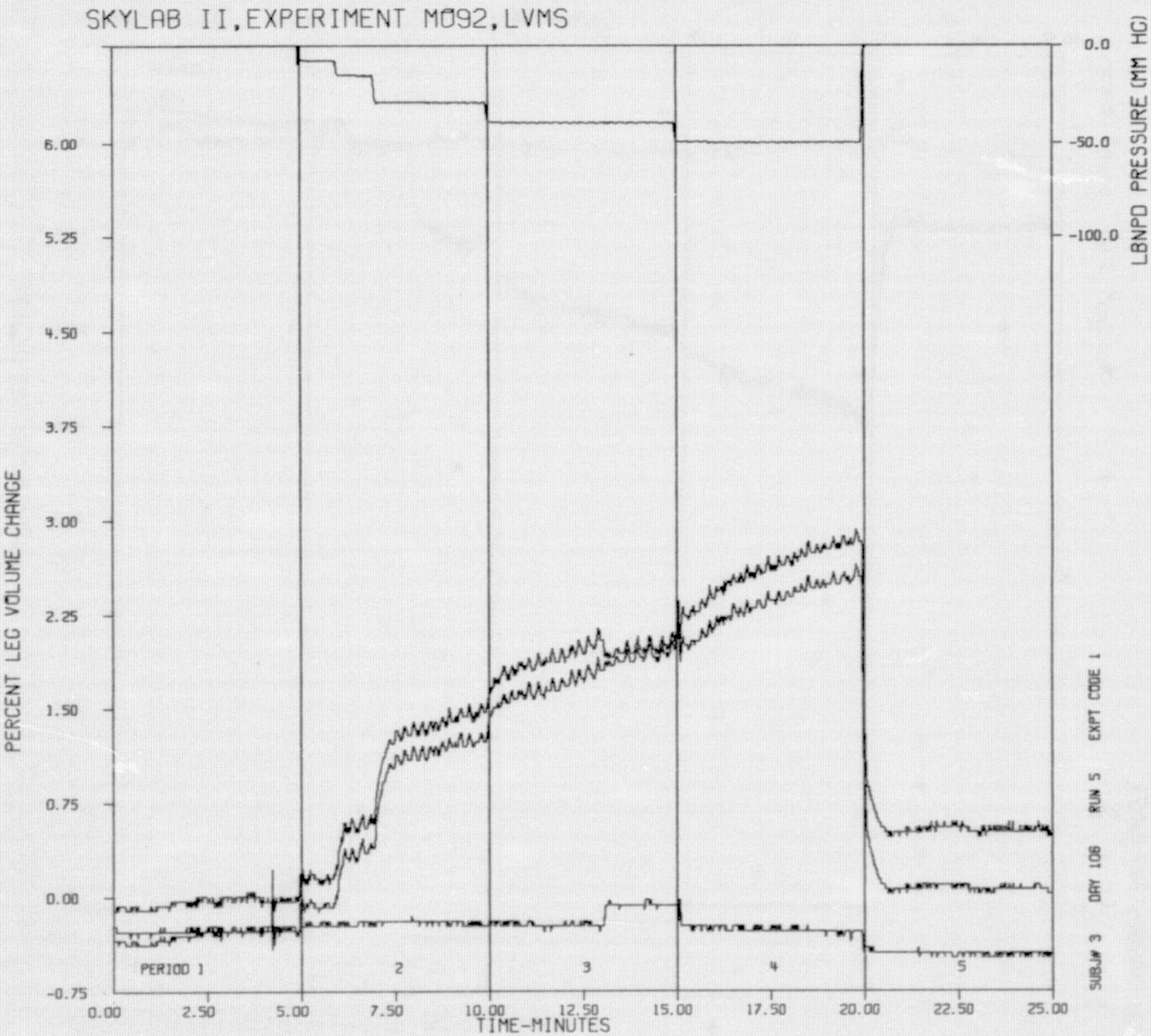

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
SUBJ# 3 DAY 30 RUN 2 EXPT CODE 1

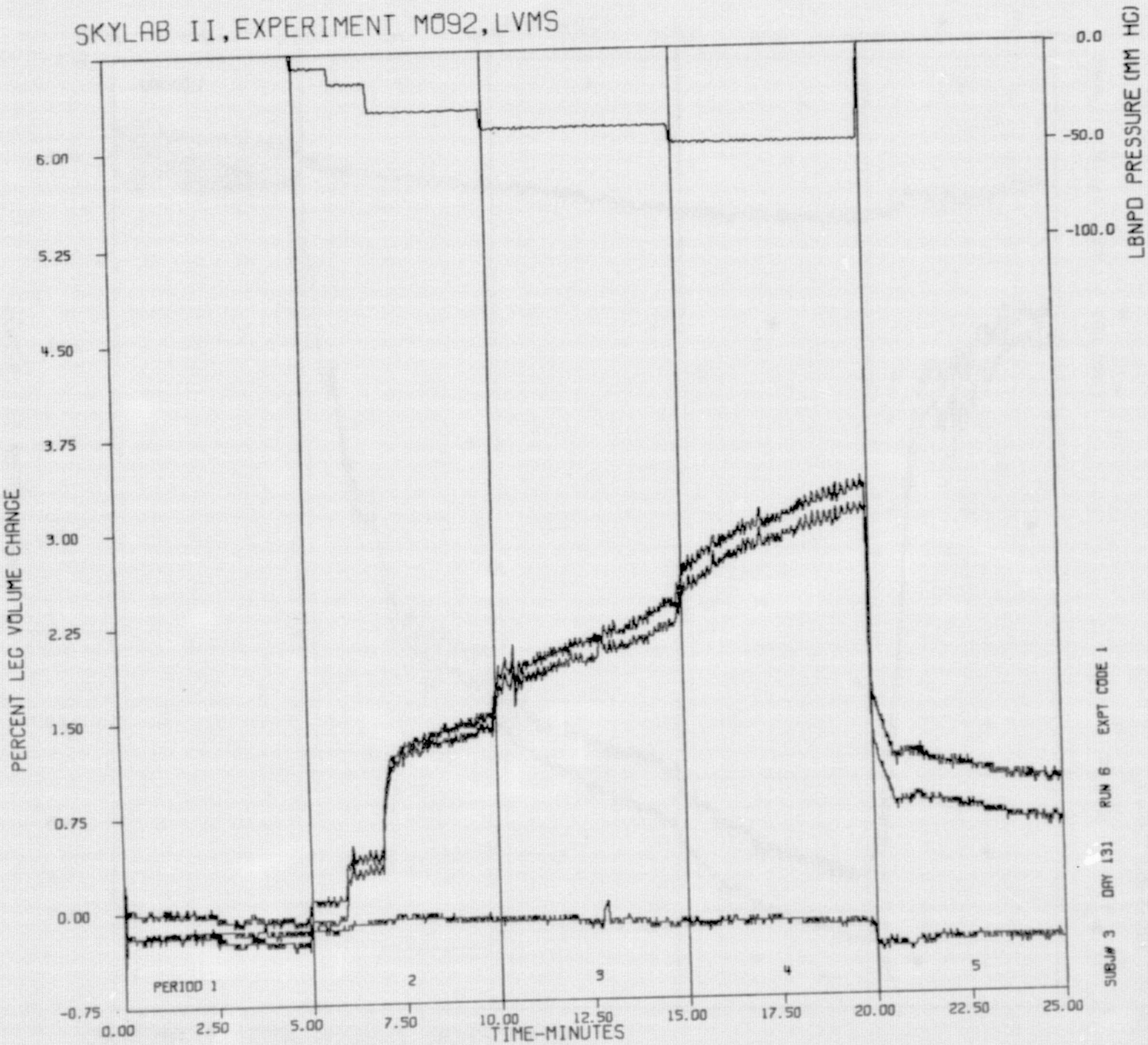
B-43



SKYLAB II, EXPERIMENT MØ92, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
SUBJ# 3
DAY 57
RUN 3
EXPT CODE 1

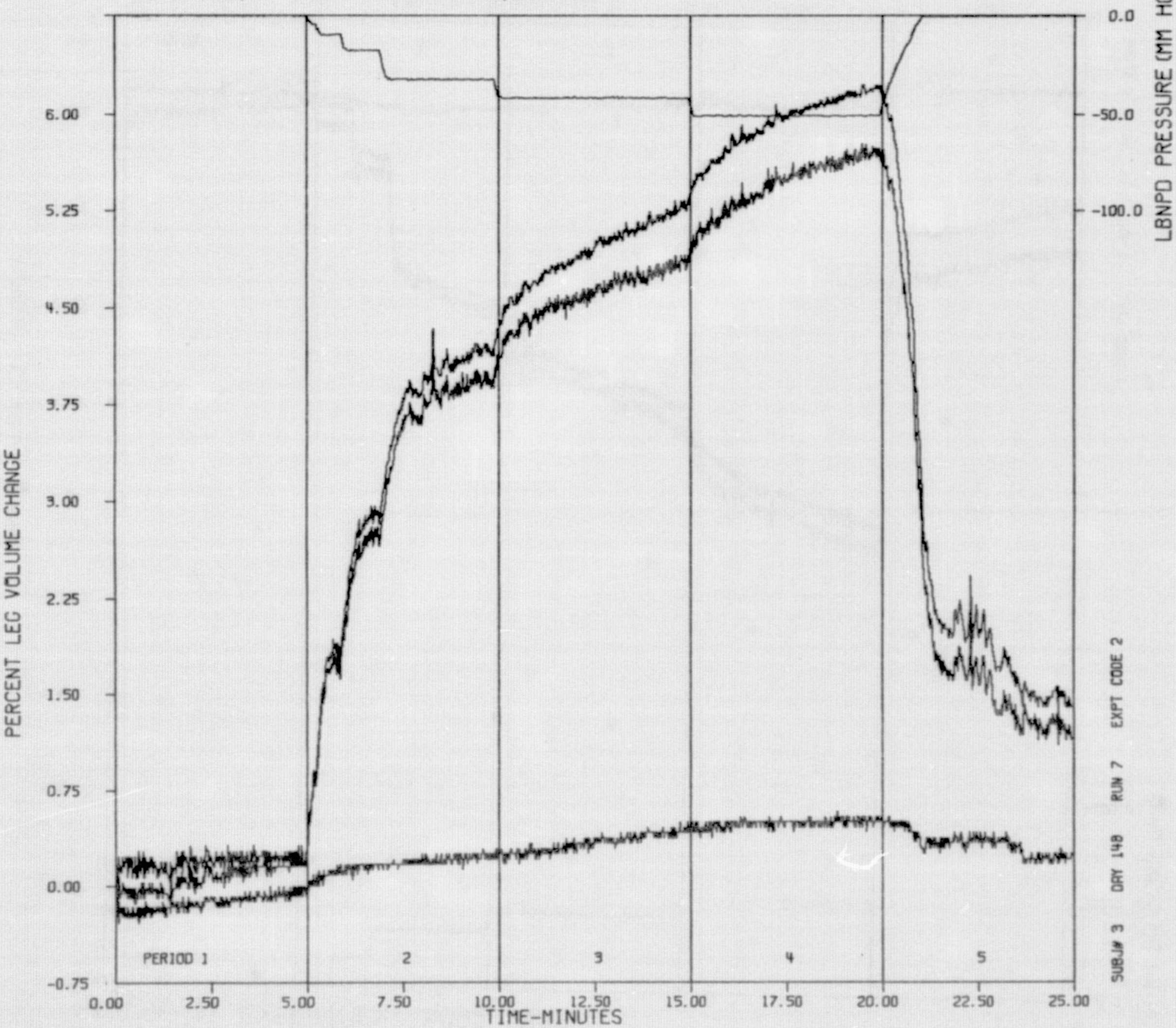

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 78 RUN 4 EXPT CODE 1

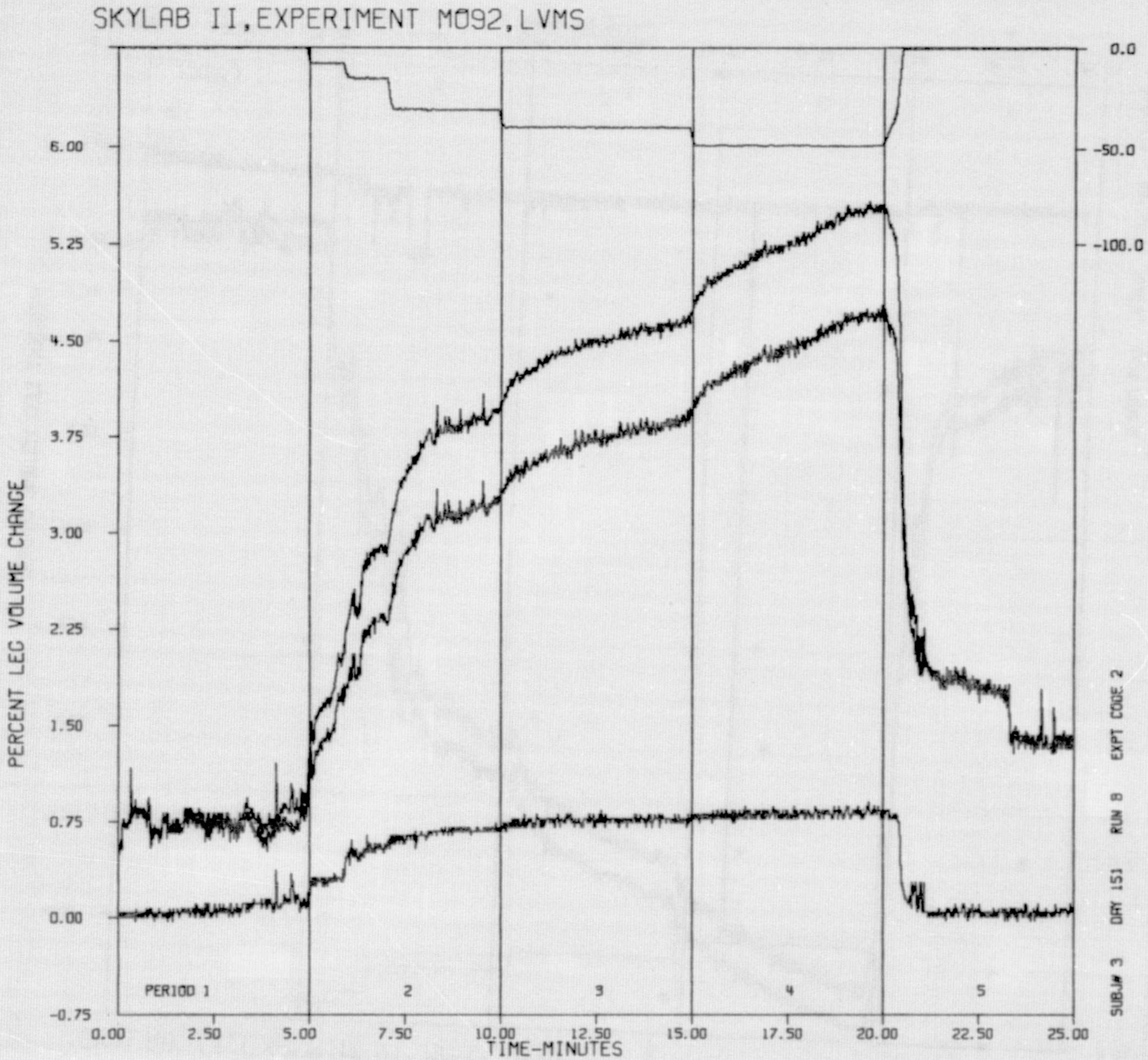

SKYLAB II, EXPERIMENT MØ92, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 106 RUN 5 EXPT CODE 1



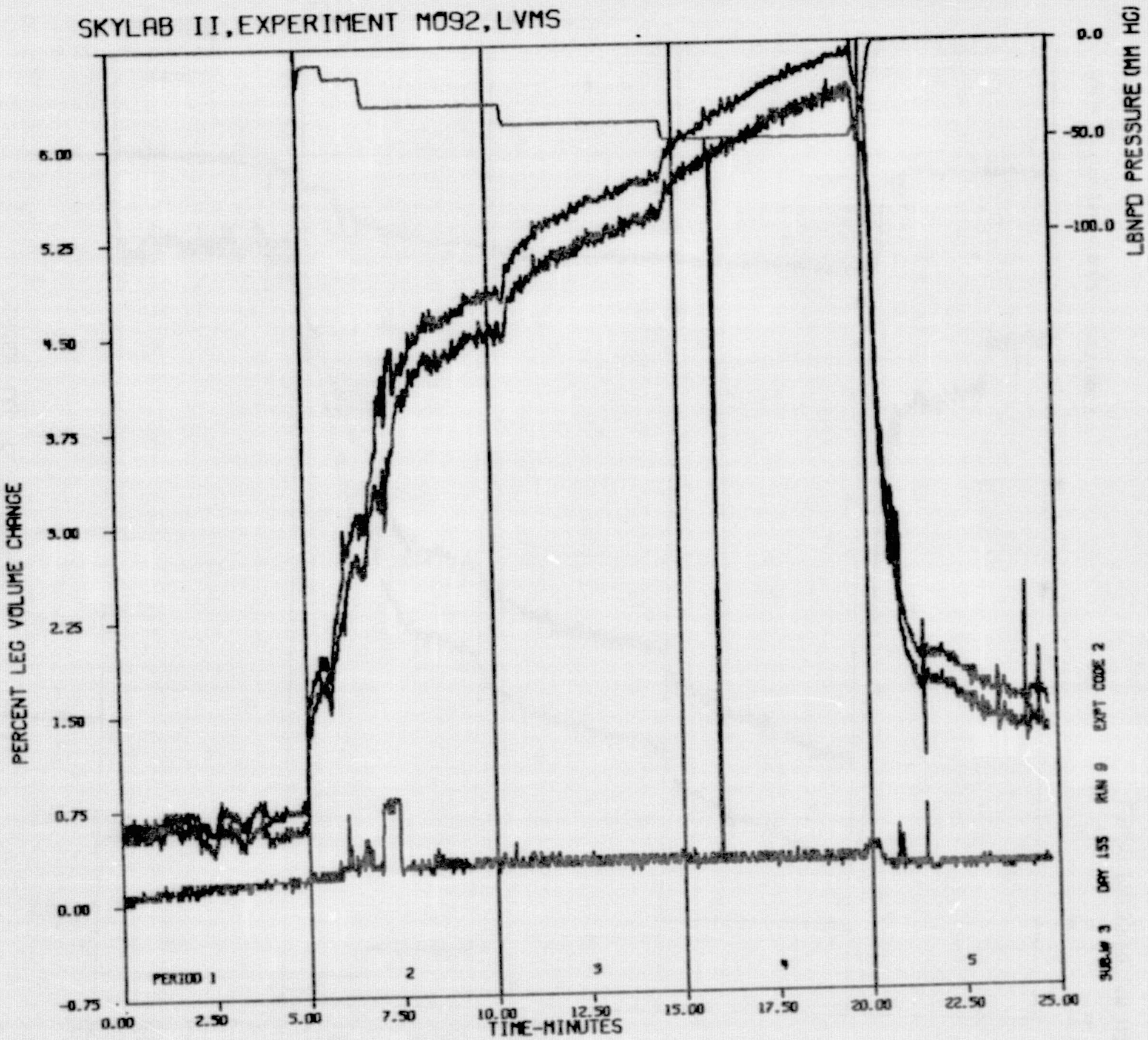
SKYLAB II, EXPERIMENT MØ92, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 131 RUN 6 EXPT CODE 1

SKYLAB II, EXPERIMENT M092, LVMS

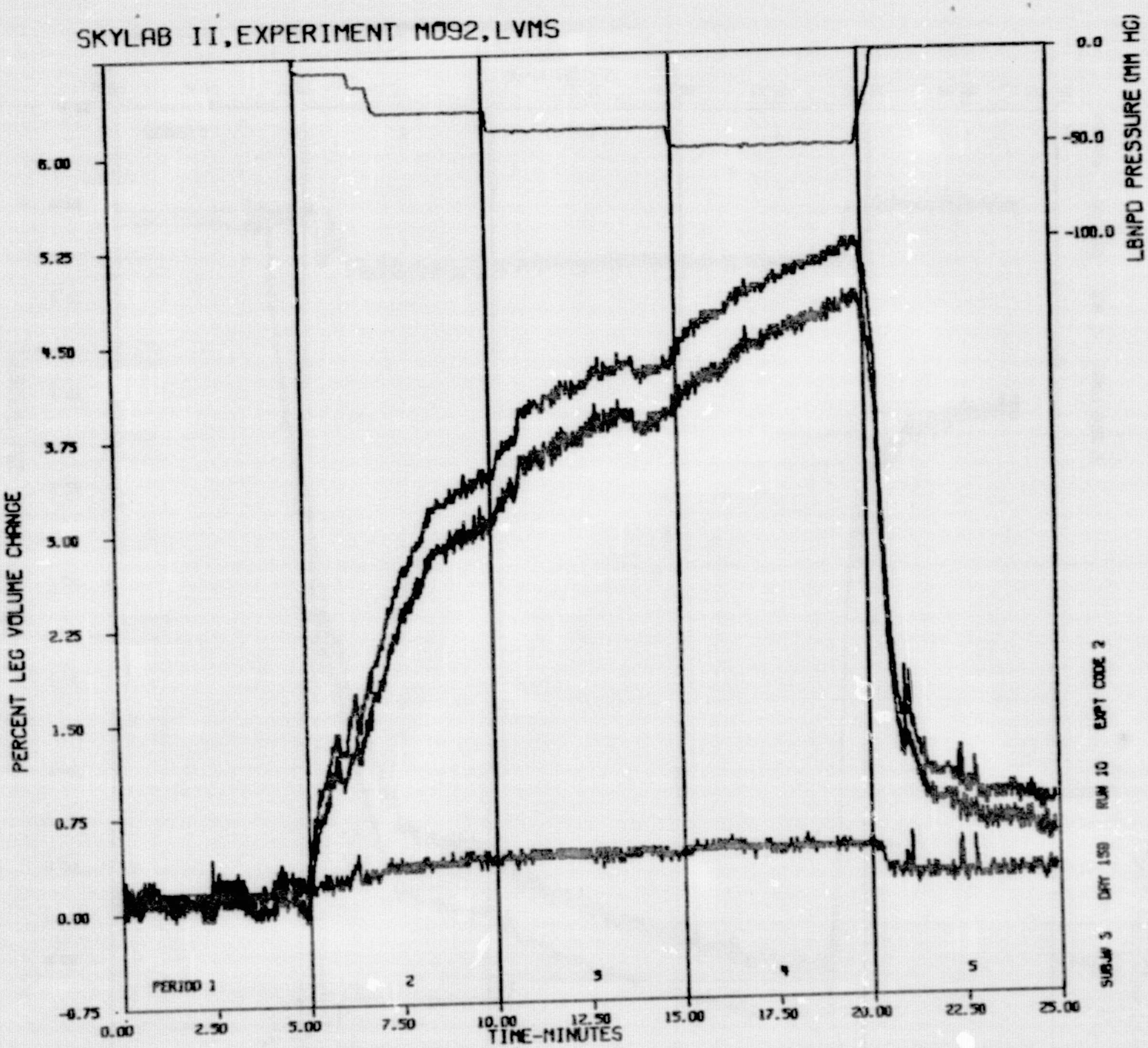


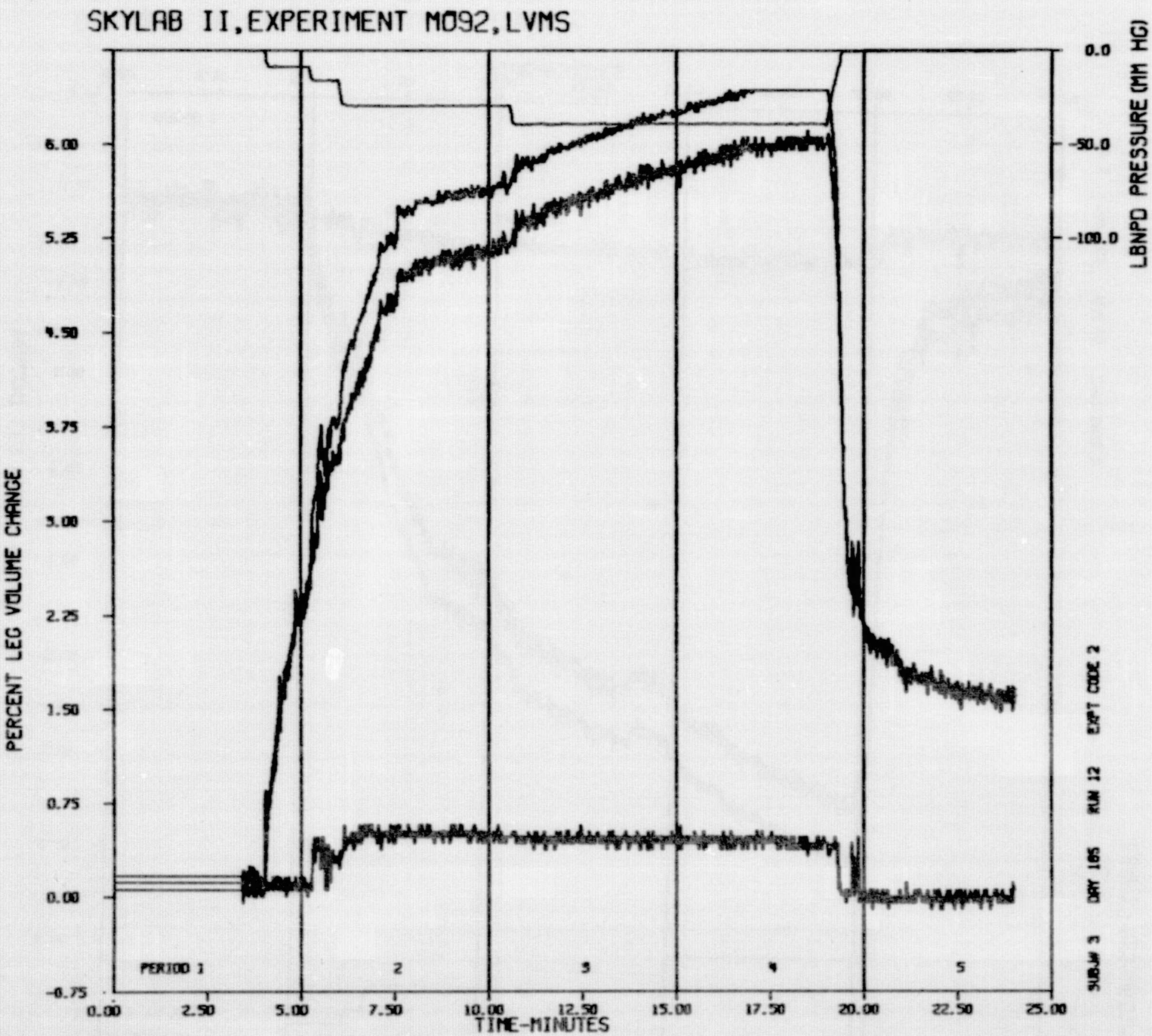


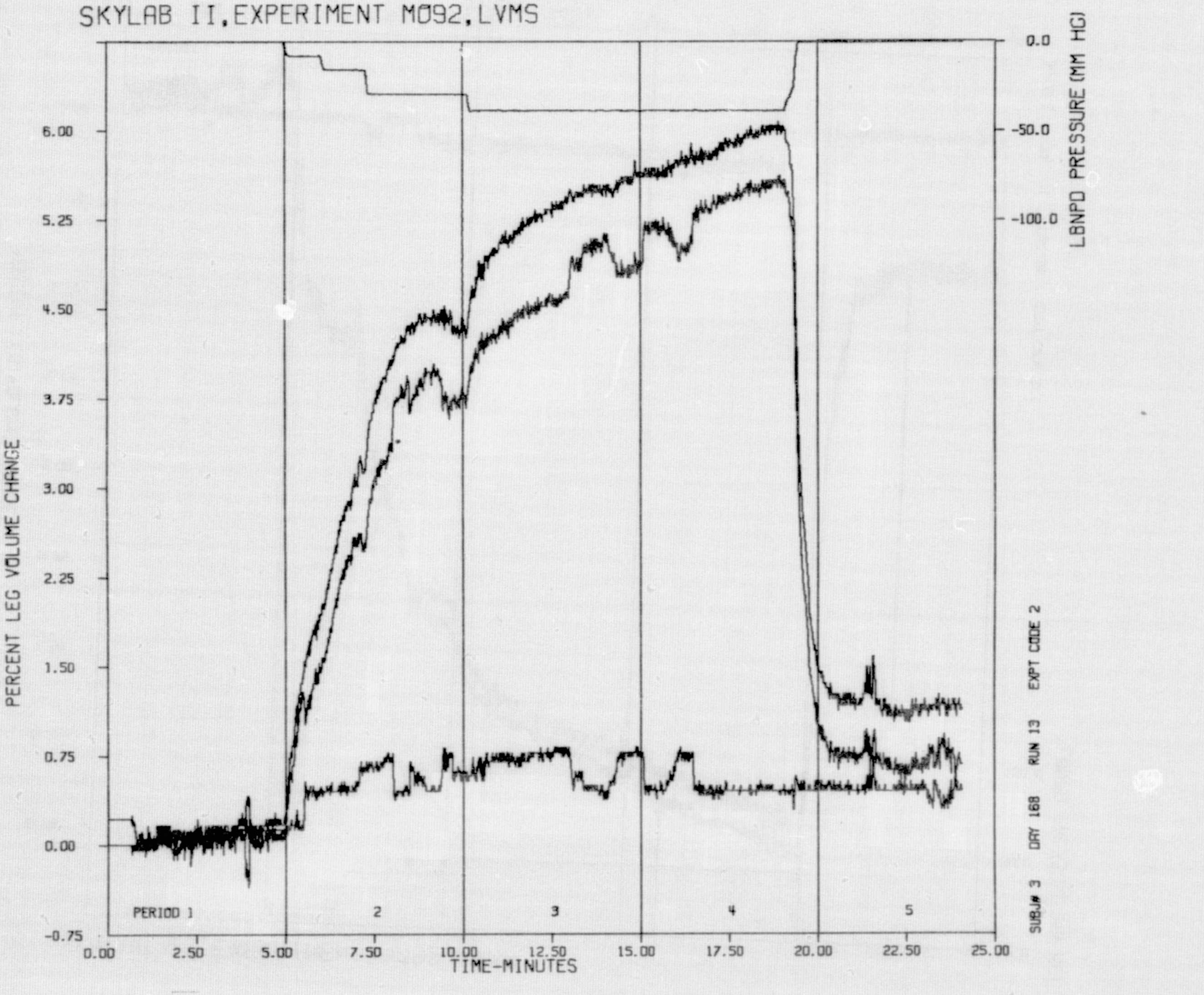
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
-0.75
0.00
0.75
1.50
2.25
3.00
3.75
4.50
5.25
6.00
0.0
-50.0
-100.0
SUBJ# 3 DAY 151 RUN 8 EXPT CODE 2

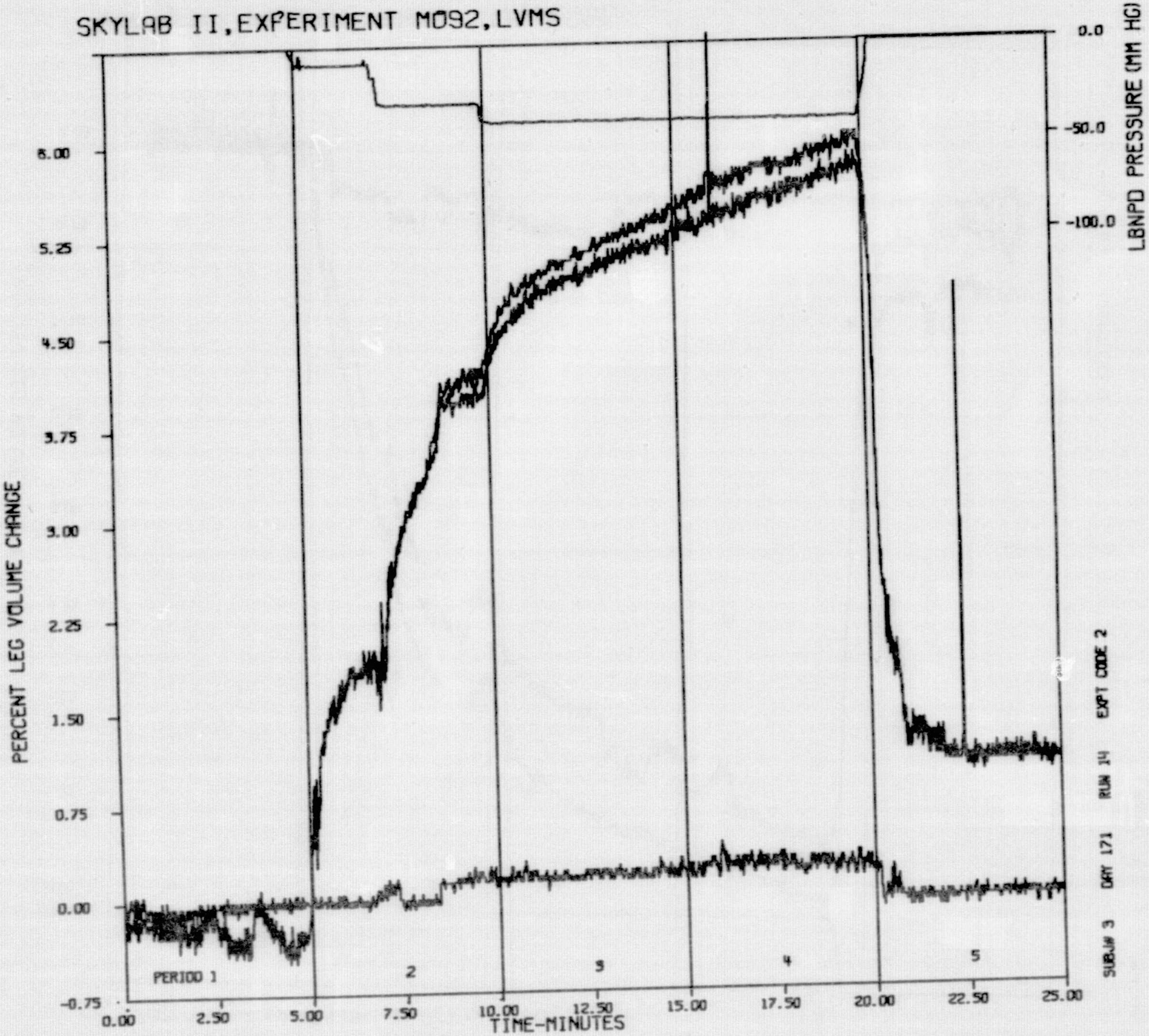


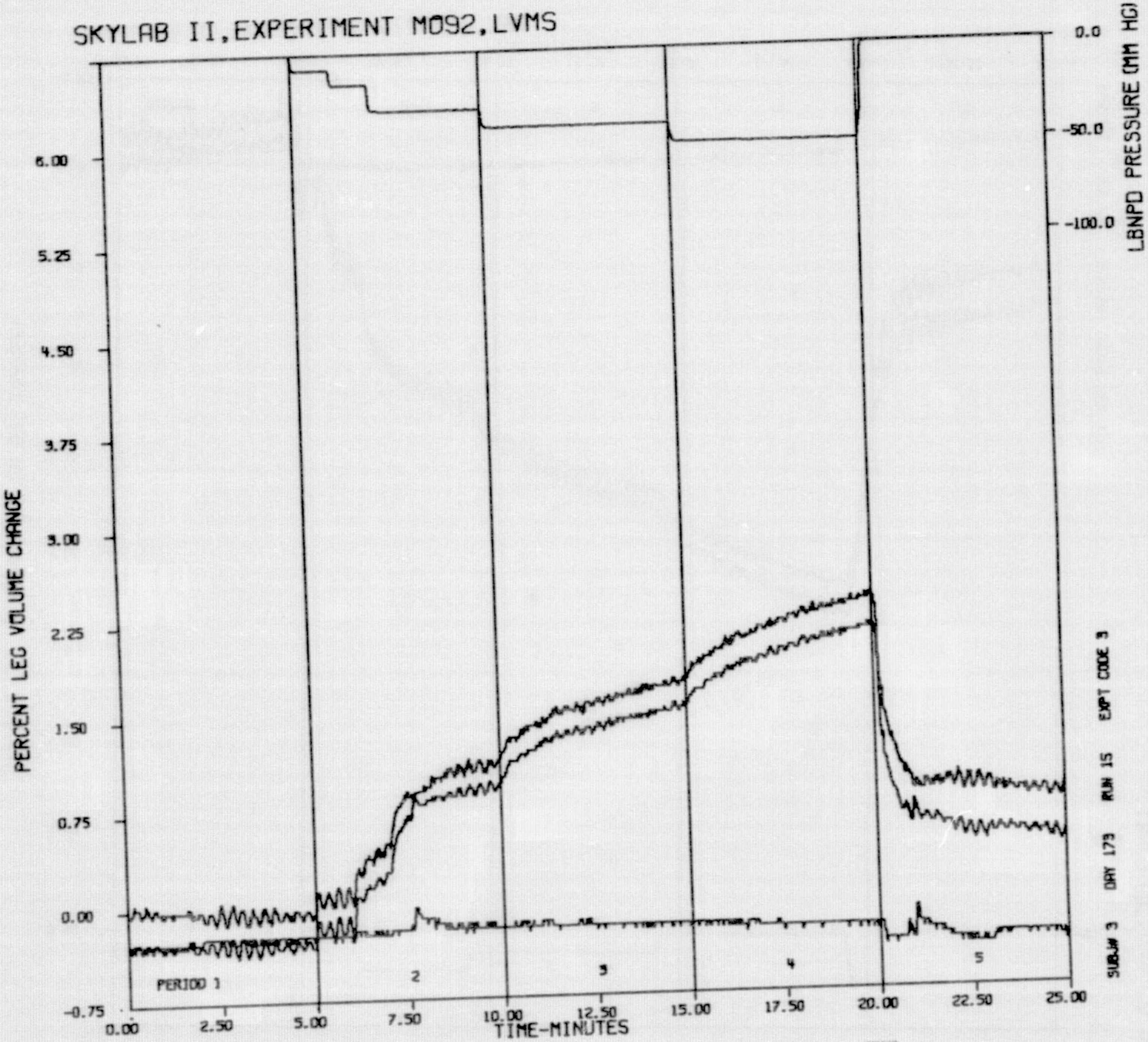
CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CALIFORNIA CHART NO. 00

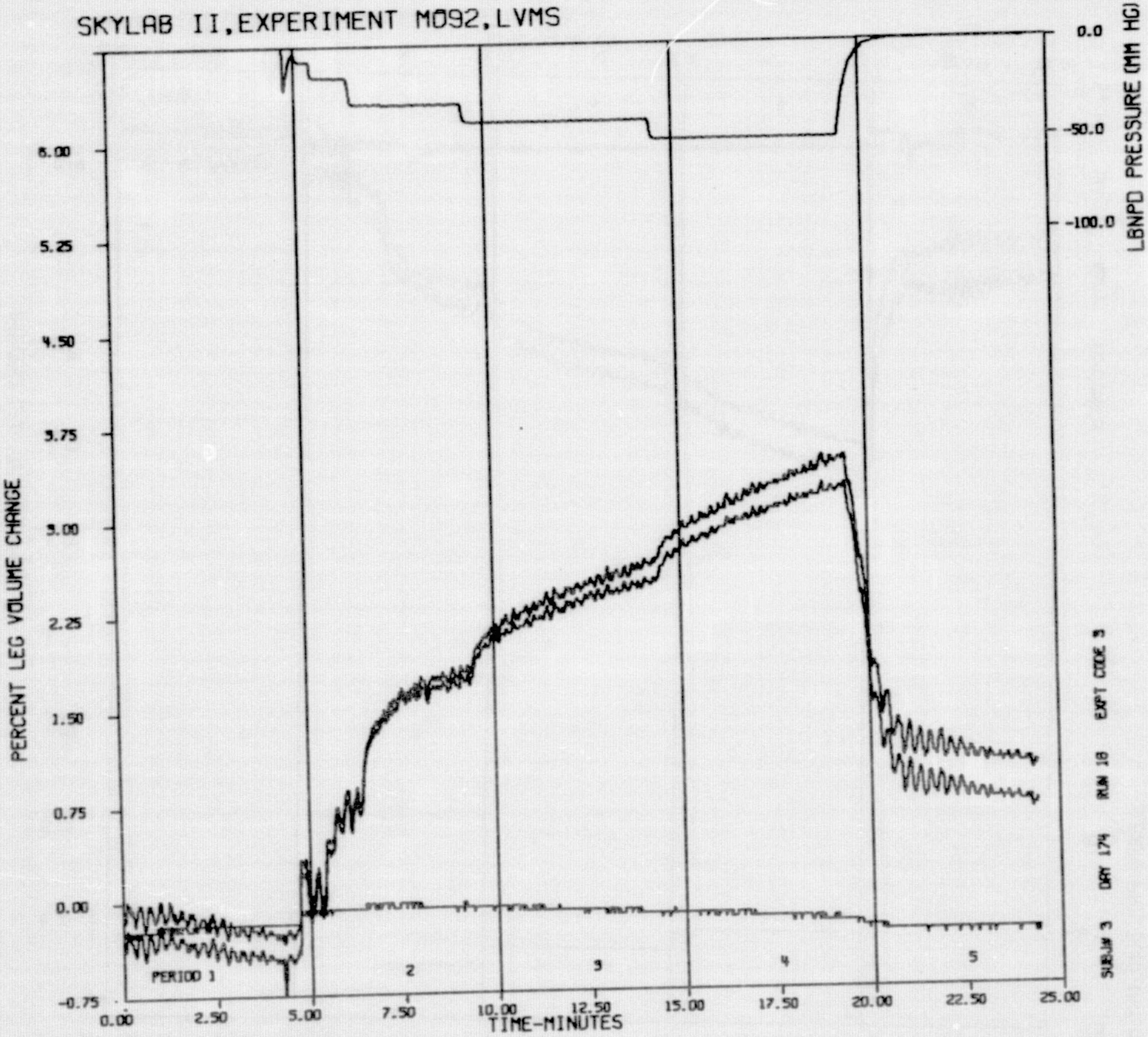

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
PERIOD 1
2
3
4
5
SUBJ# 5 DAY 158 RUN 10 EXPT CODE 2


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
DAY 165
RUN 12
EXPT CODE 2

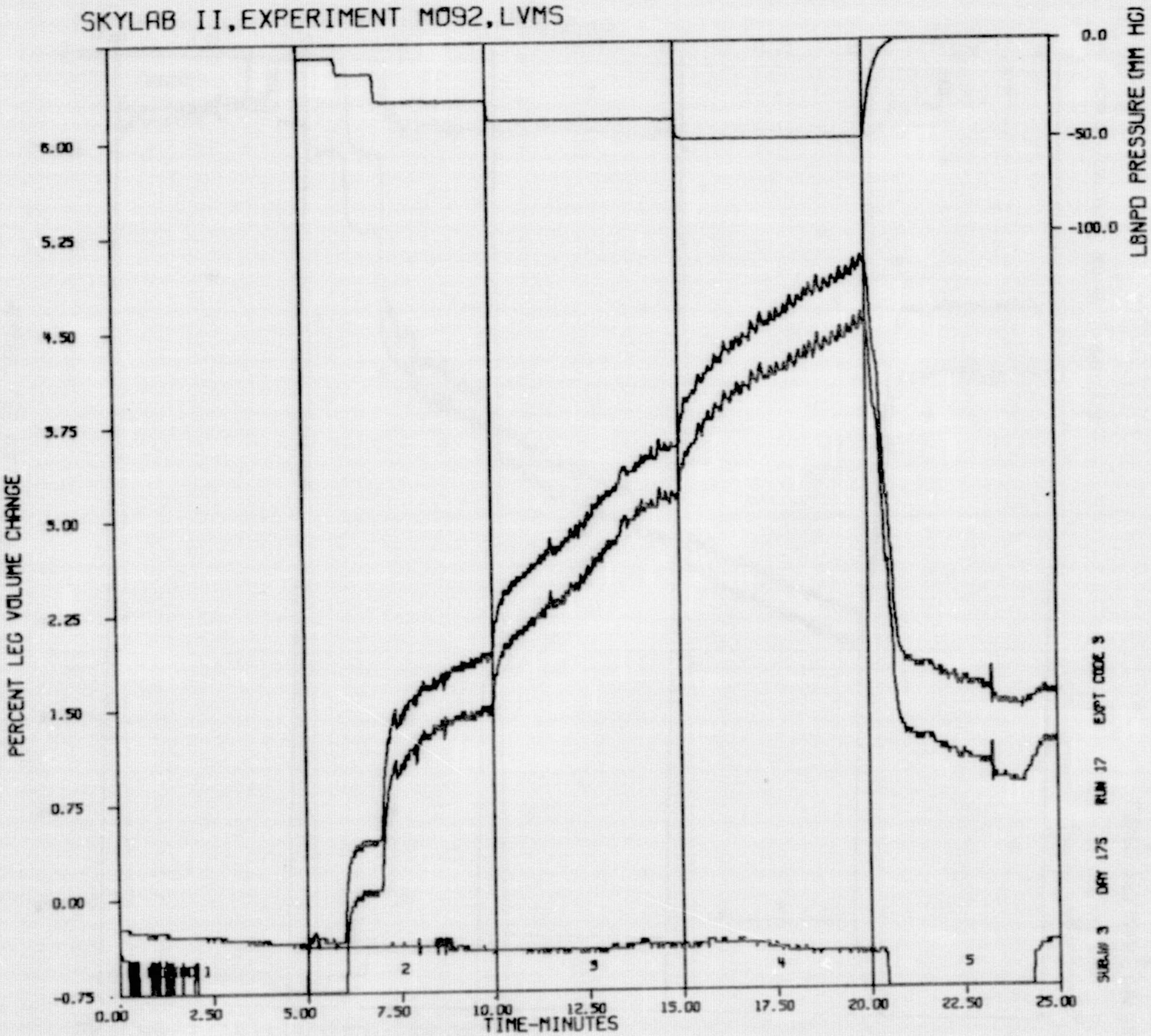

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 168 RUN 13 EXPT CODE 2
CALIFORNIA COMPUTER P

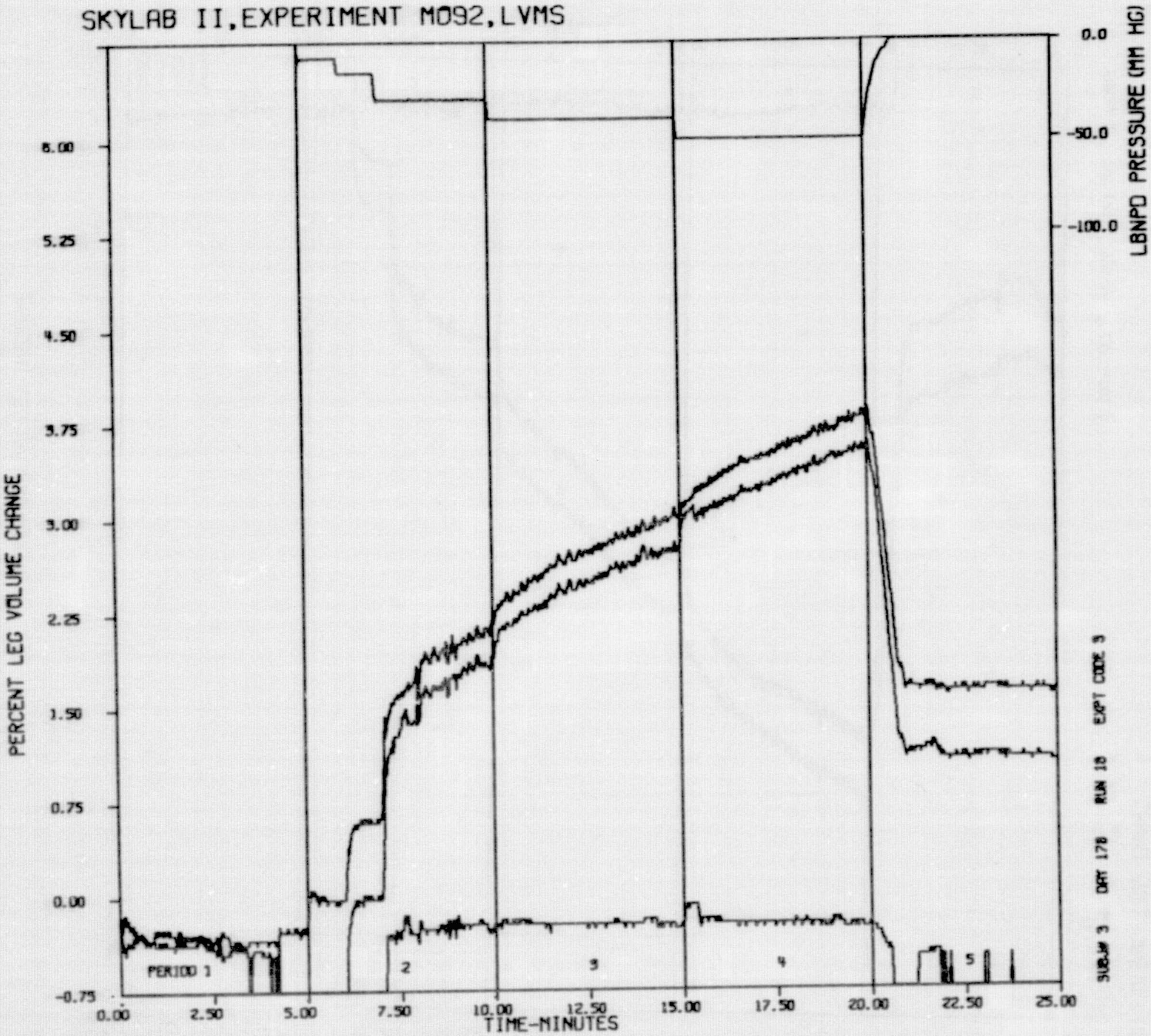

SKYLAB II, EXPERIMENT M092, LVMS
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 171 RUN 14 EXPT CODE 2

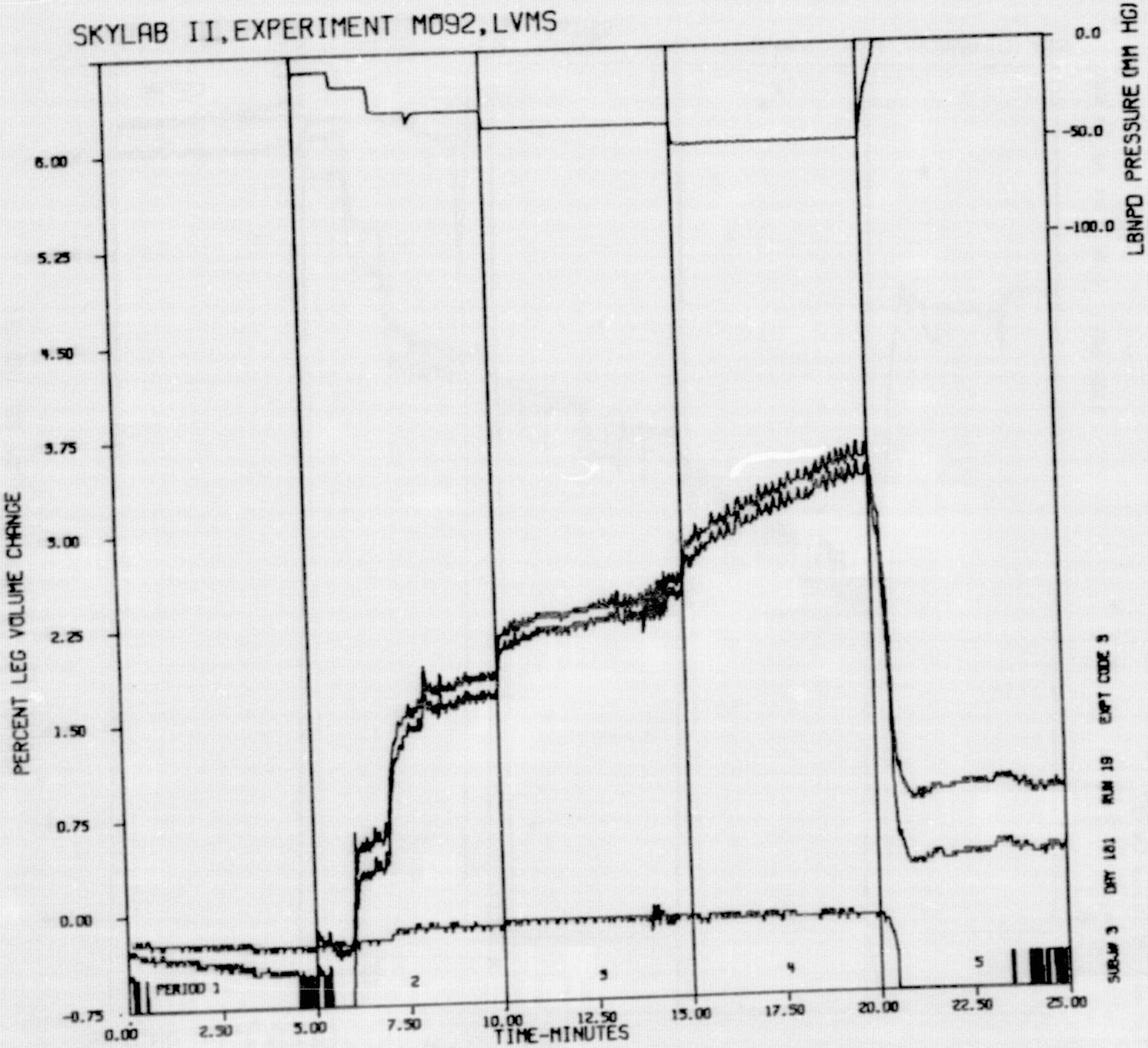

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
PERIOD 1
2
3
4
5
SUBJW 3 DAY 173 RUN 15 EXPT CODE 3

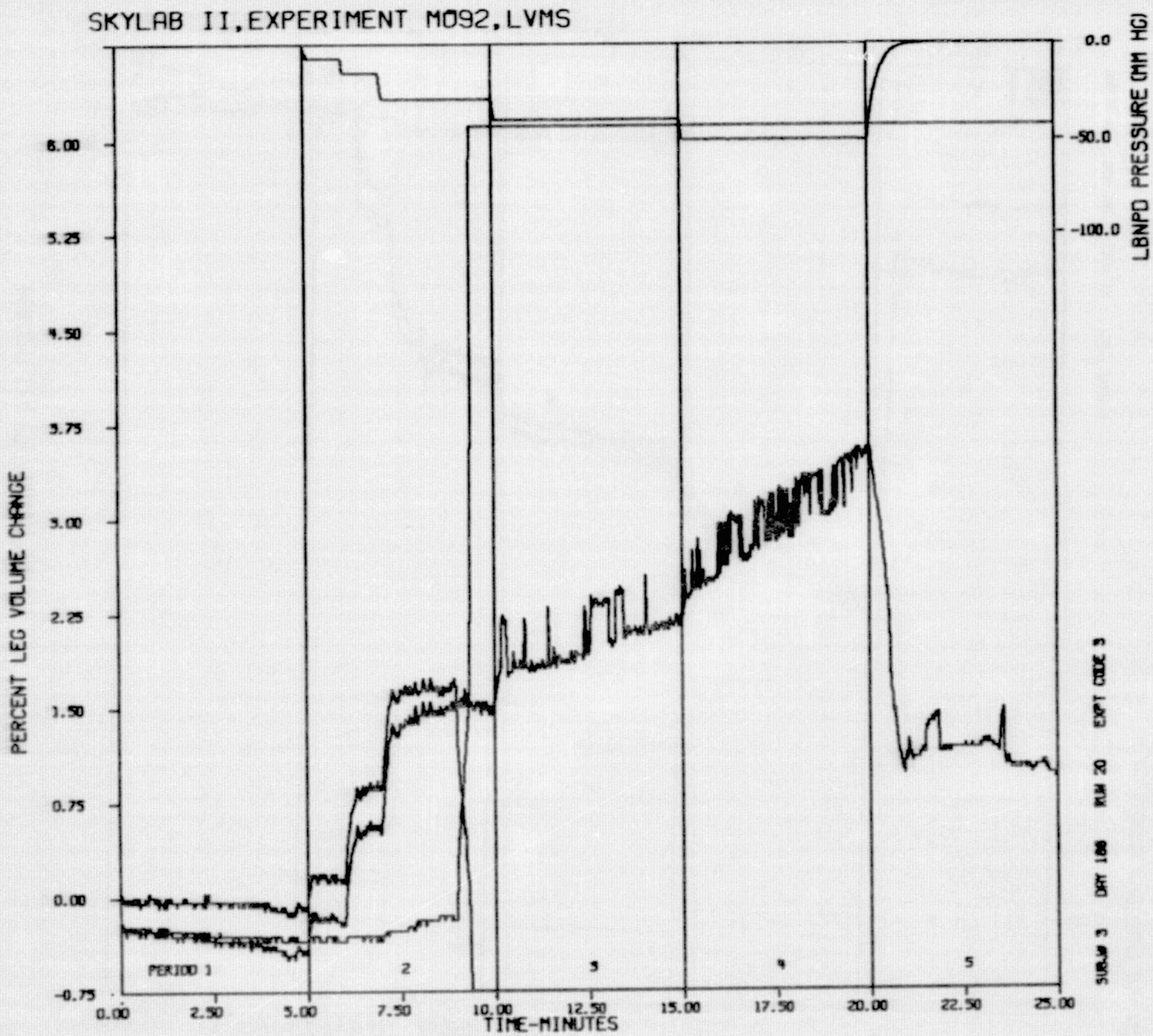


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
TIME-MINUTES
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3
DAY 174
RUN 18
EXPT CODE 9

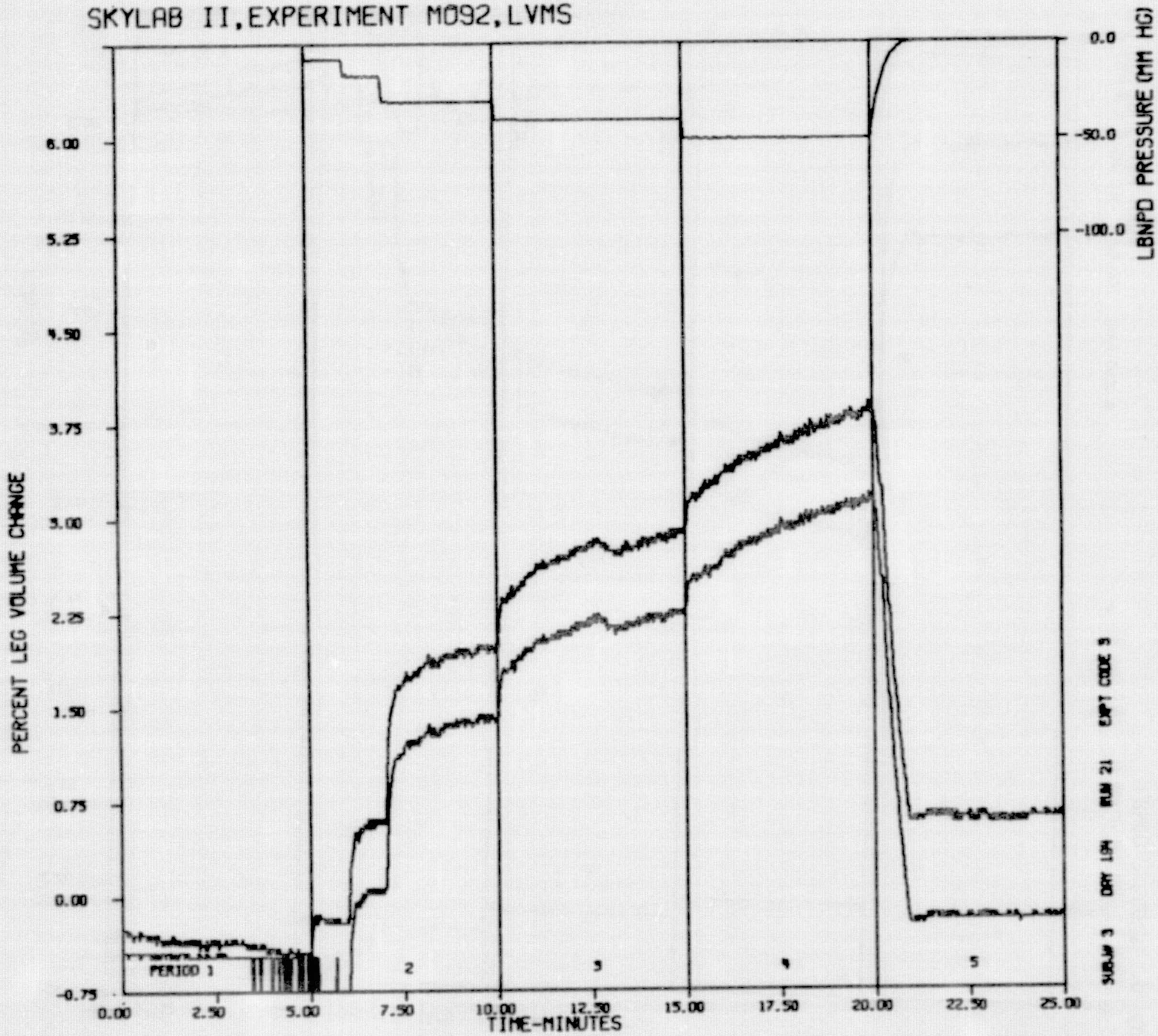

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
1
2
3
4
5
SUBJ# 3 DAY 175 RUN 17 EXPT CODE 3


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3
DAY 178
RUN 18
EXPT CODE 3

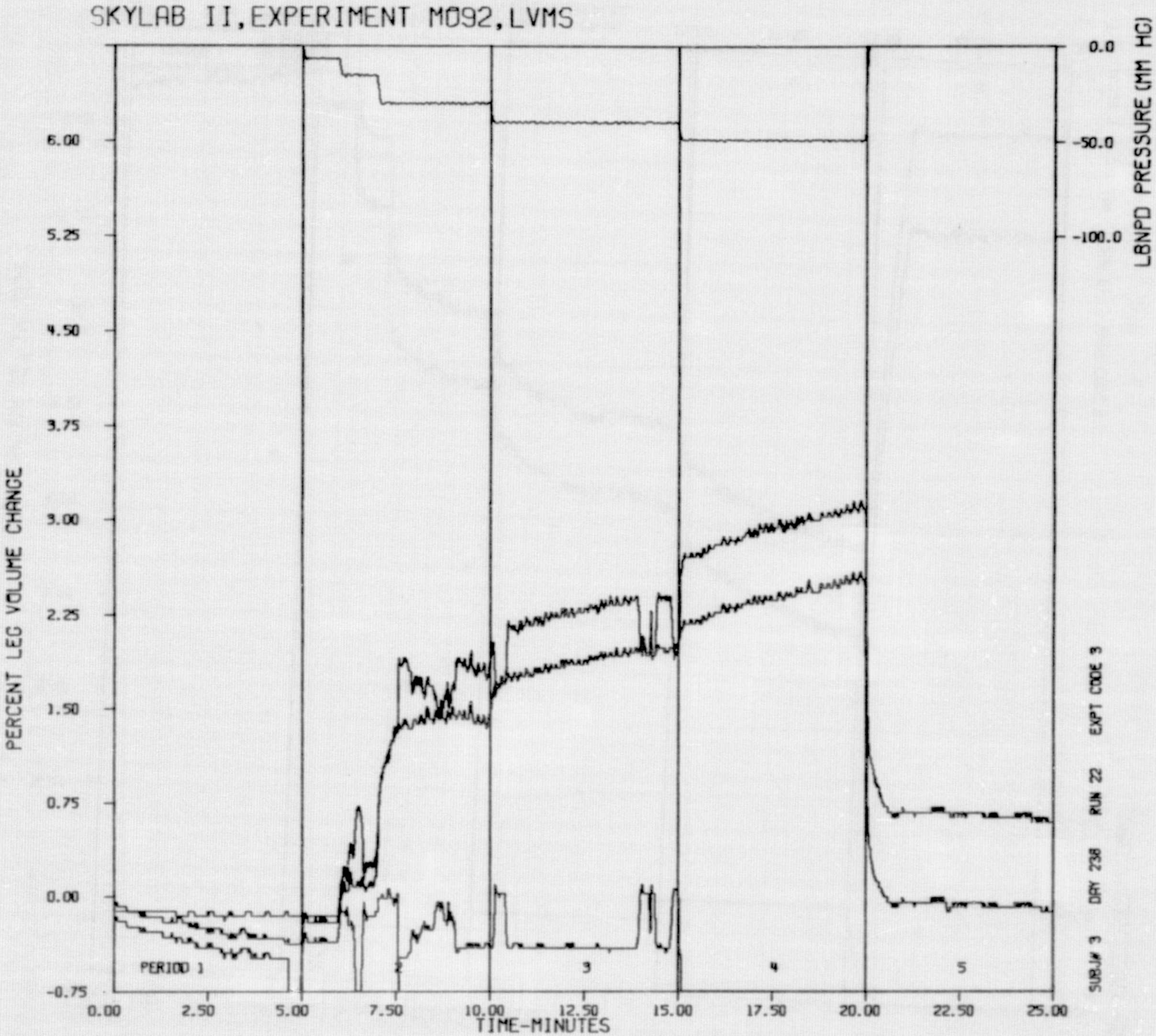

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ 3 DAY 161 RUN 19 EXPT CODE 3



SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 188 RUN 20 EXPT CODE 9



SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 104 RUN 21 EXPT CODE 9



SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 238 RUN 22 EXPT CODE 3

APPENDIX C

DESCRIPTORS FOR RUN TYPE CODE

1. Data OK
2. Missing Data
3. Questionable or bad data
4. Short Record
5. Data over range
6. 10 min at -40 mm Hg
7. Timing off
8. Rt leg offset - used left leg instead of PLVC data
9.
10.

Combinations - 2nd digit indicates 2nd condition

21 -- 30 Missing data

31 -- 40 Questionable or bad data

41 -- 50 Presyncope

51 -- 60 Data over range

61 -- 70 10 min at -40 mm Hg

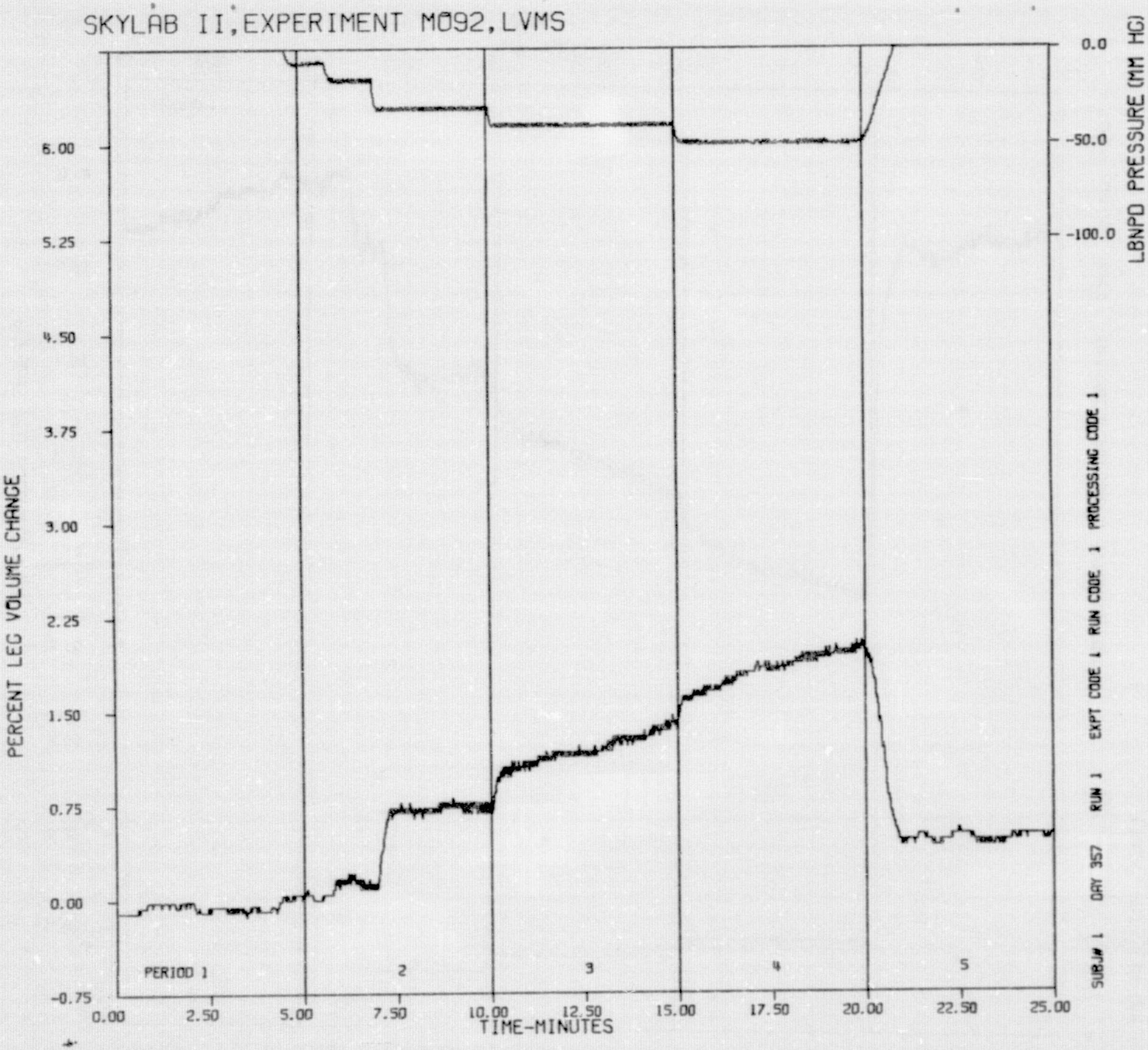
71 -- 80 Timing off

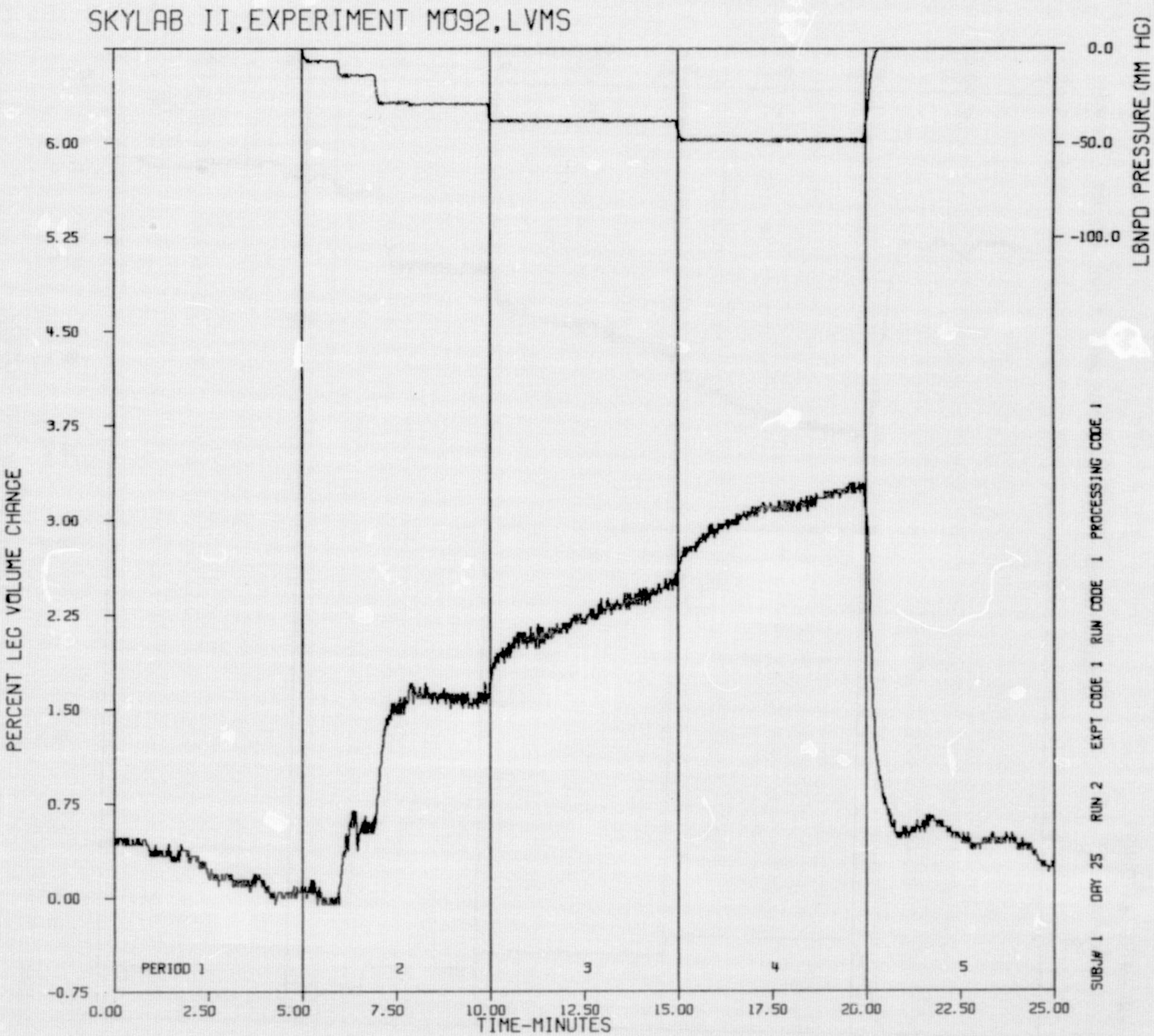
81 -- 90 Rt leg offset - used left leg

FOR COMBINATION CODES THE 2ND DIGIT SHOULD ALWAYS BE LARGER THAN THE FIRST DIGIT (i.e., 28, 78)

APPENDIX D

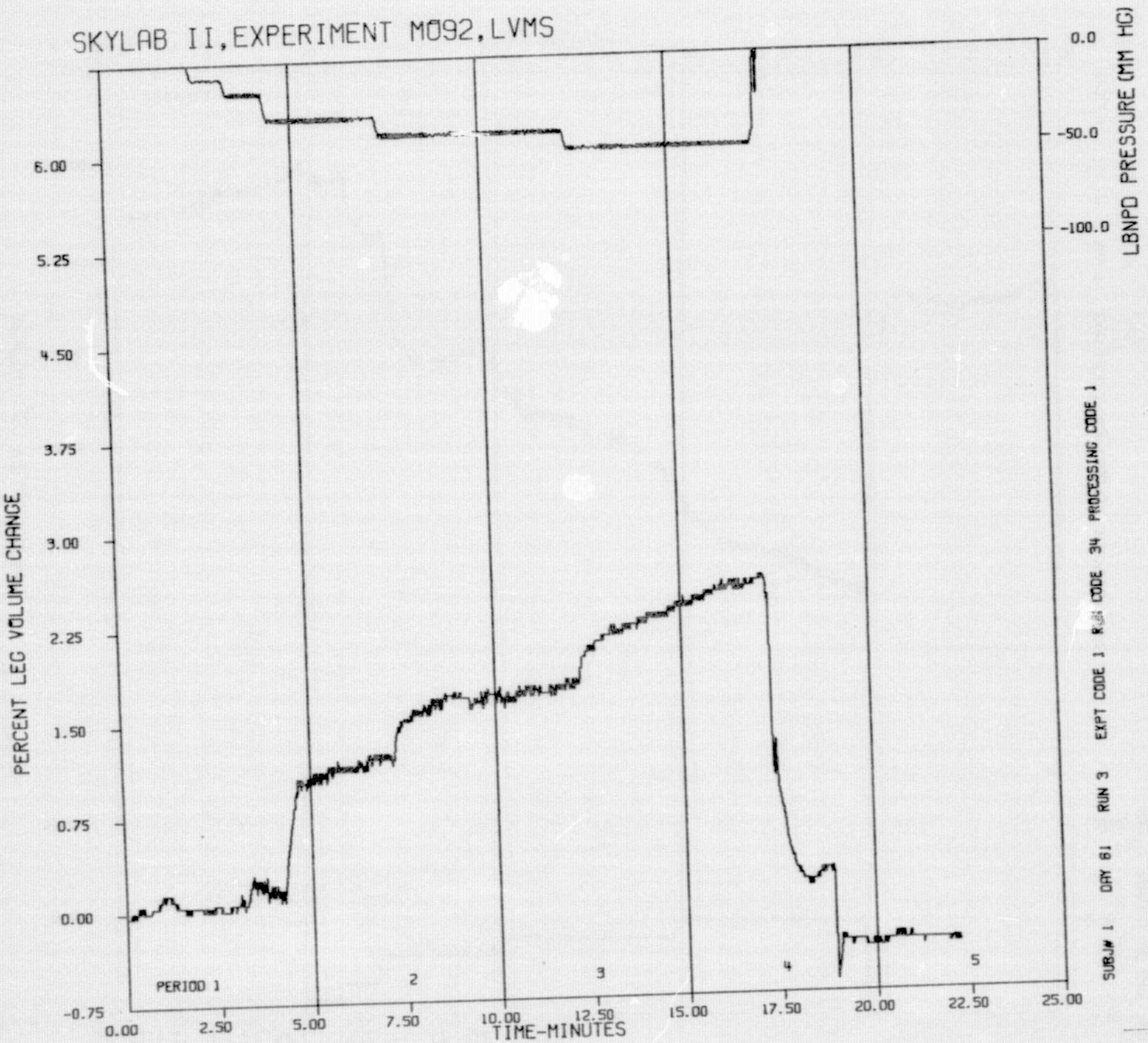
PLOTS OF PROCESSED DATA


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 357 RUN 1 EXPT CODE 1 RUN CODE 1 PROCESSING CODE 1

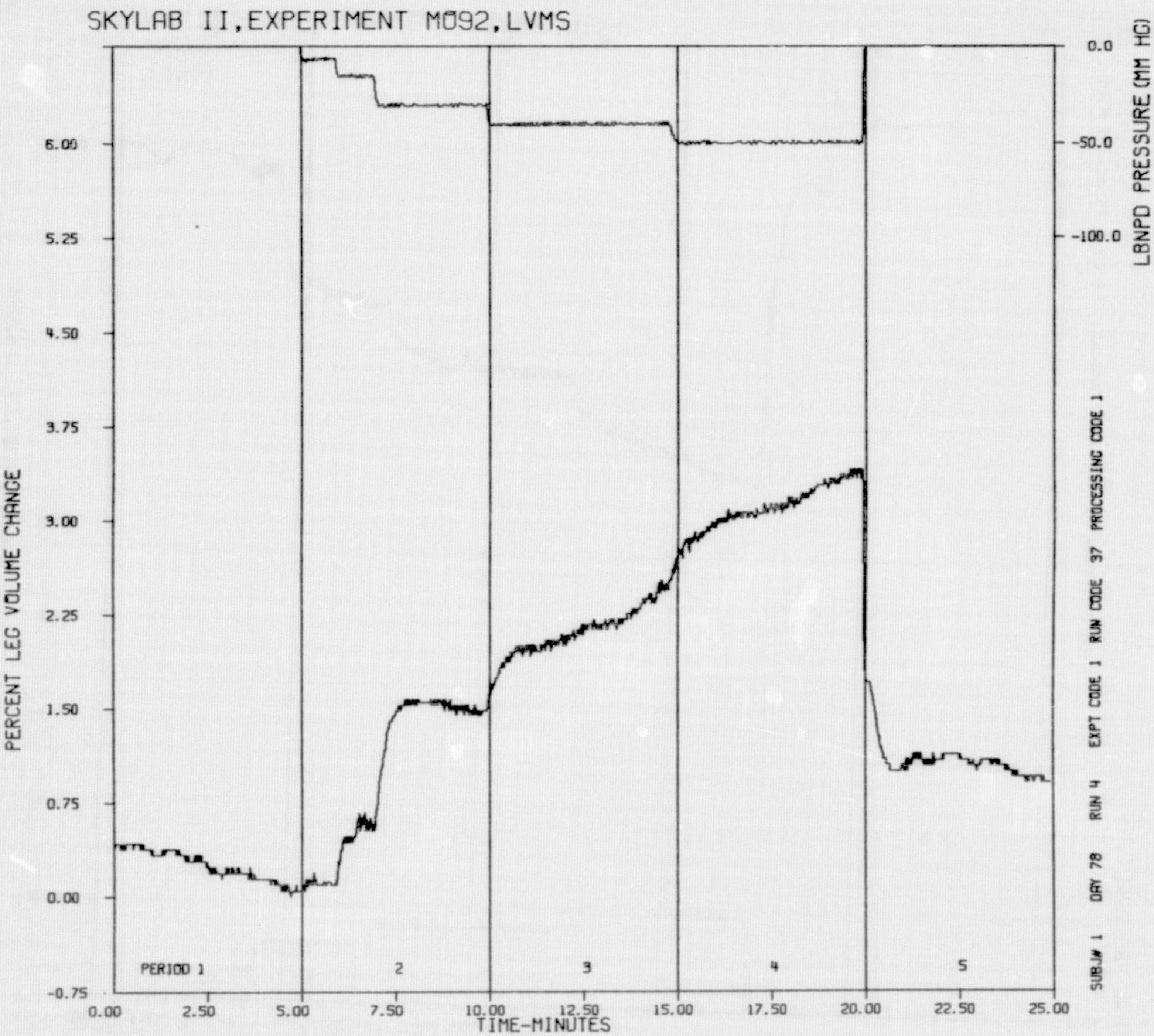


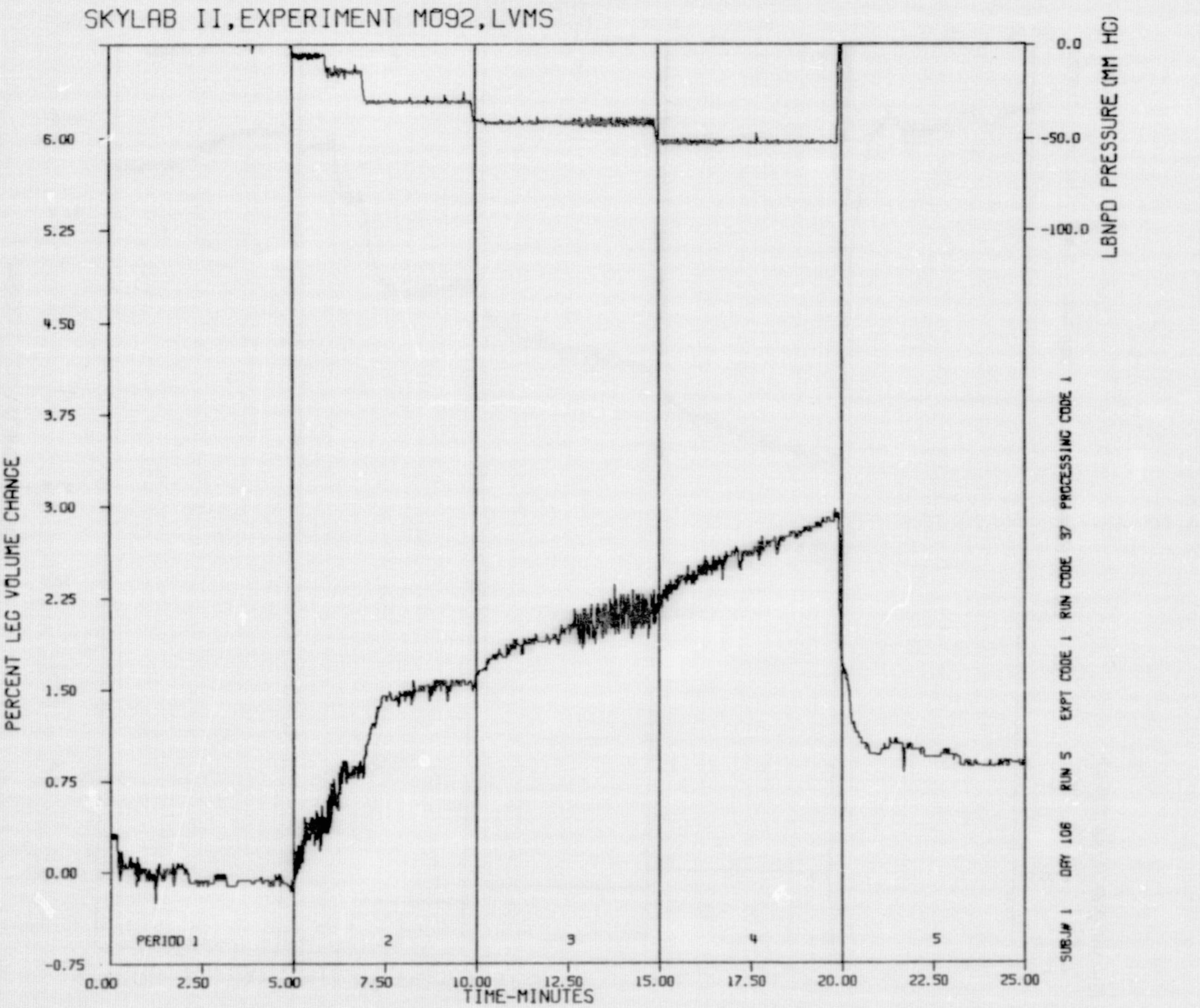
D-2

CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CALIFORNIA CHART NO. 00

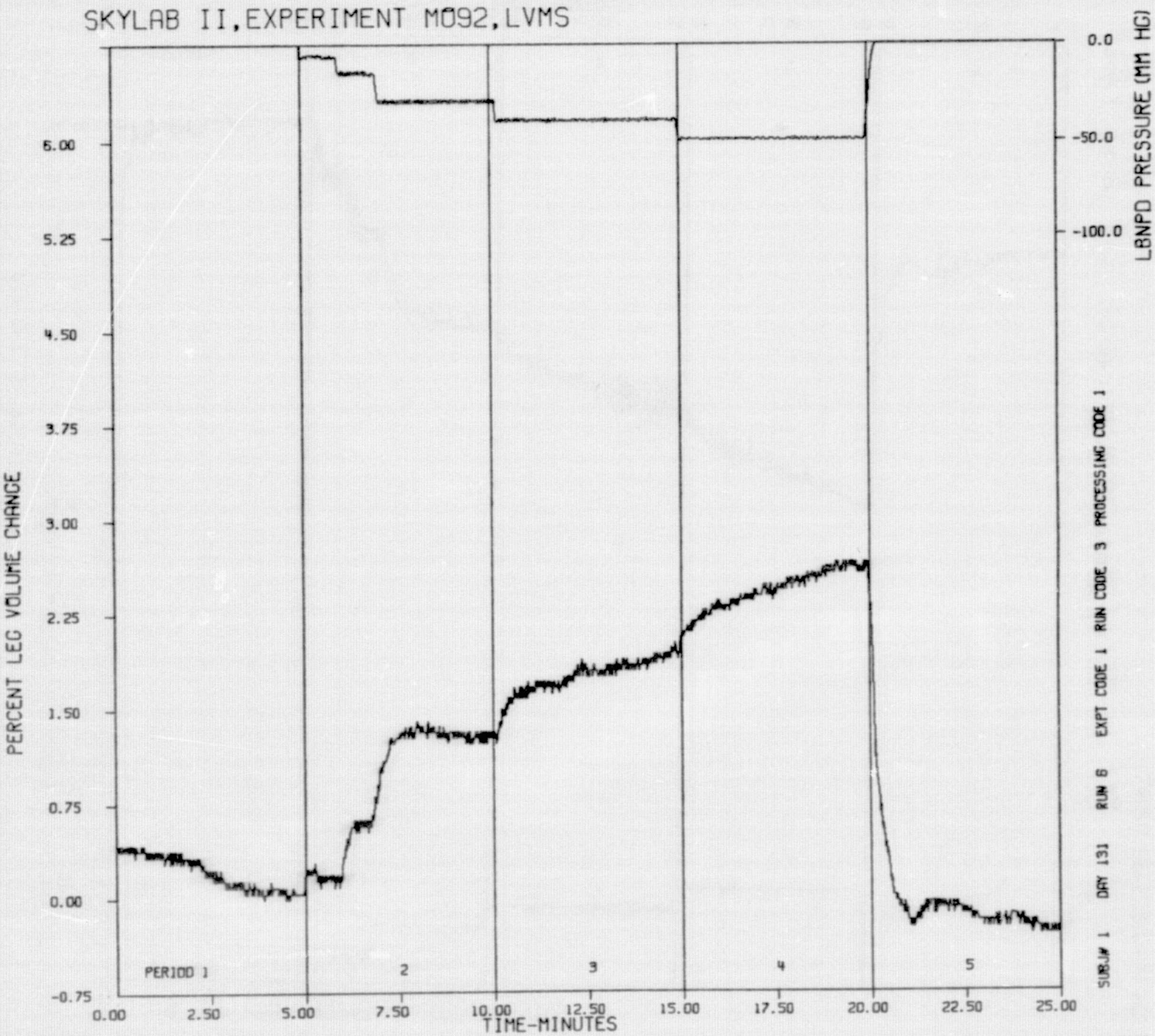


D-3
CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CALIF.


SKYLAB II, EXPERIMENT MØ92, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 78 RUN 4 EXPT CODE 1 RUN CODE 37 PROCESSING CODE 1

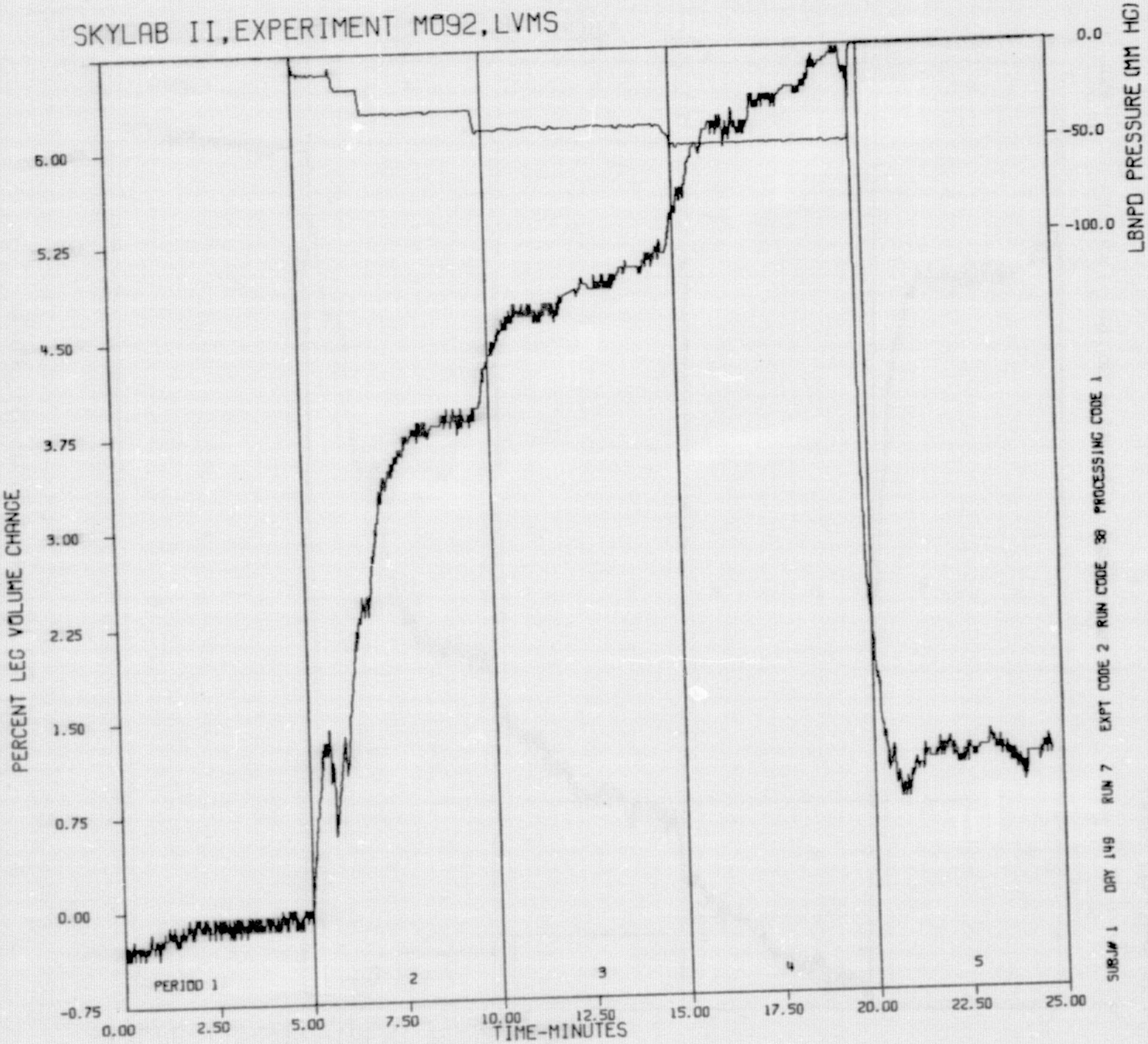


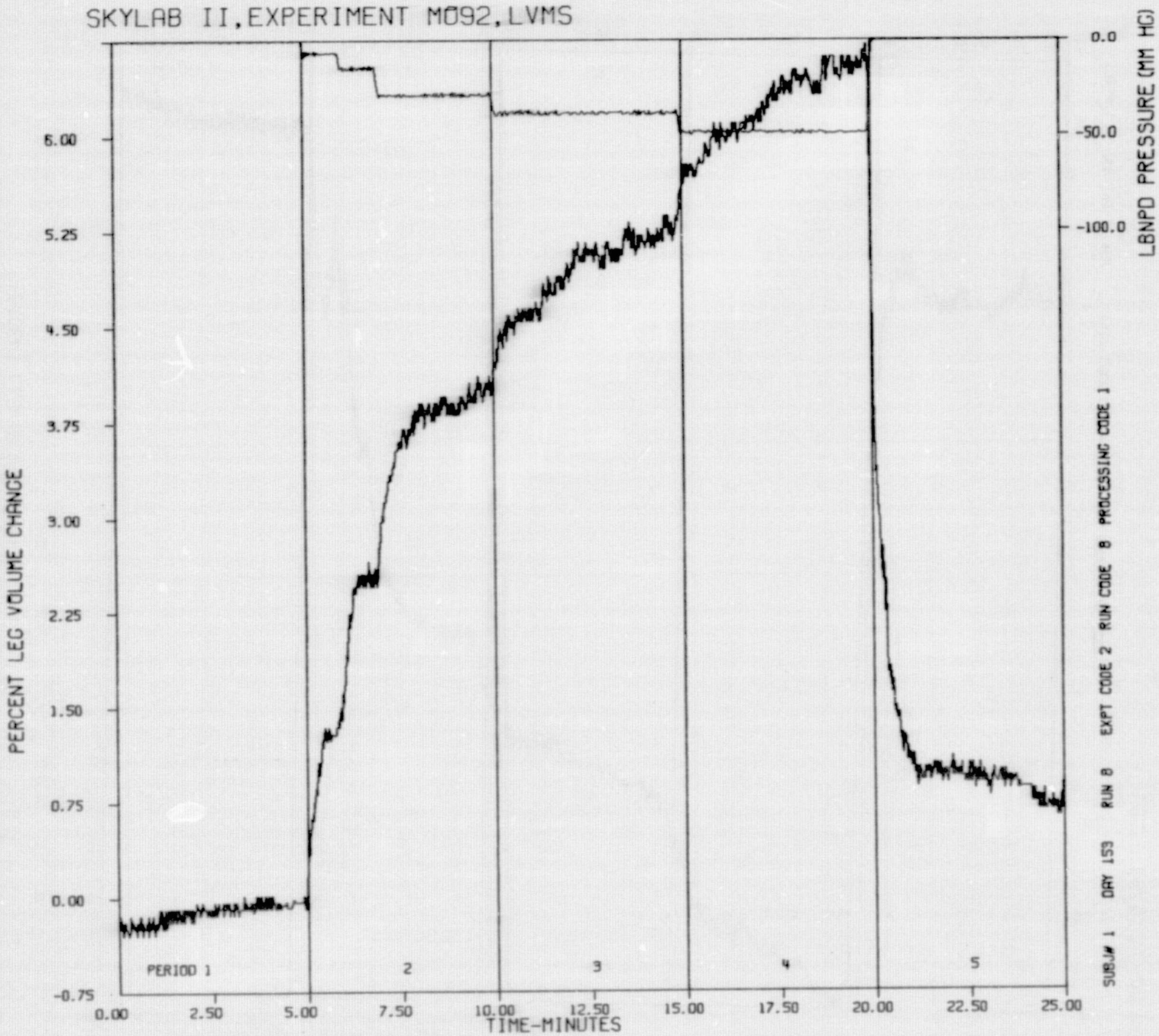
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
SUBJ# 1 DAY 106 RUN 5 EXPT CODE 1 RUN CODE 37 PROCESSING CODE 1

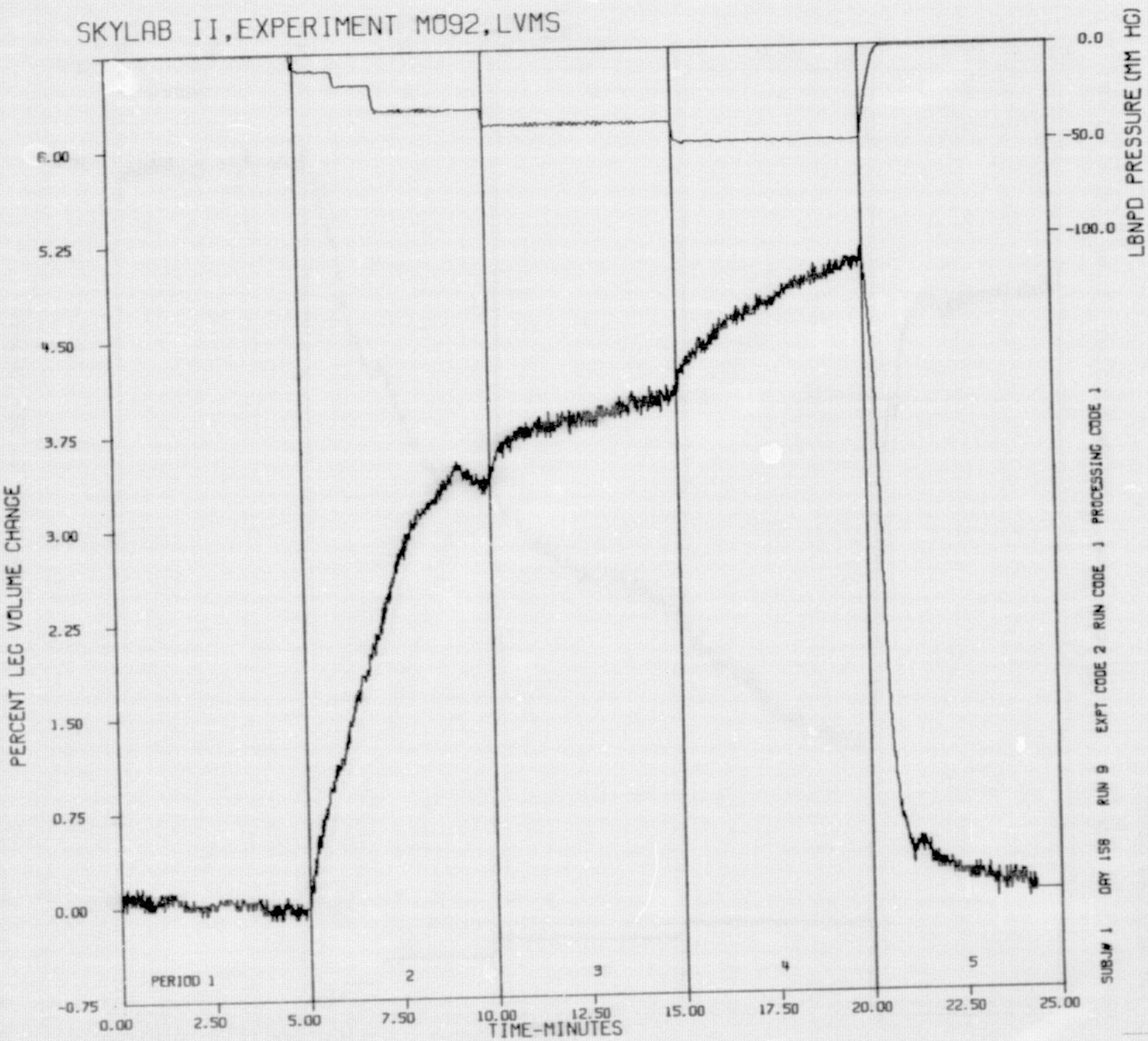


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 131 RUN 6 EXPT CODE 1 RUN CODE 3 PROCESSING CODE 1

D-6

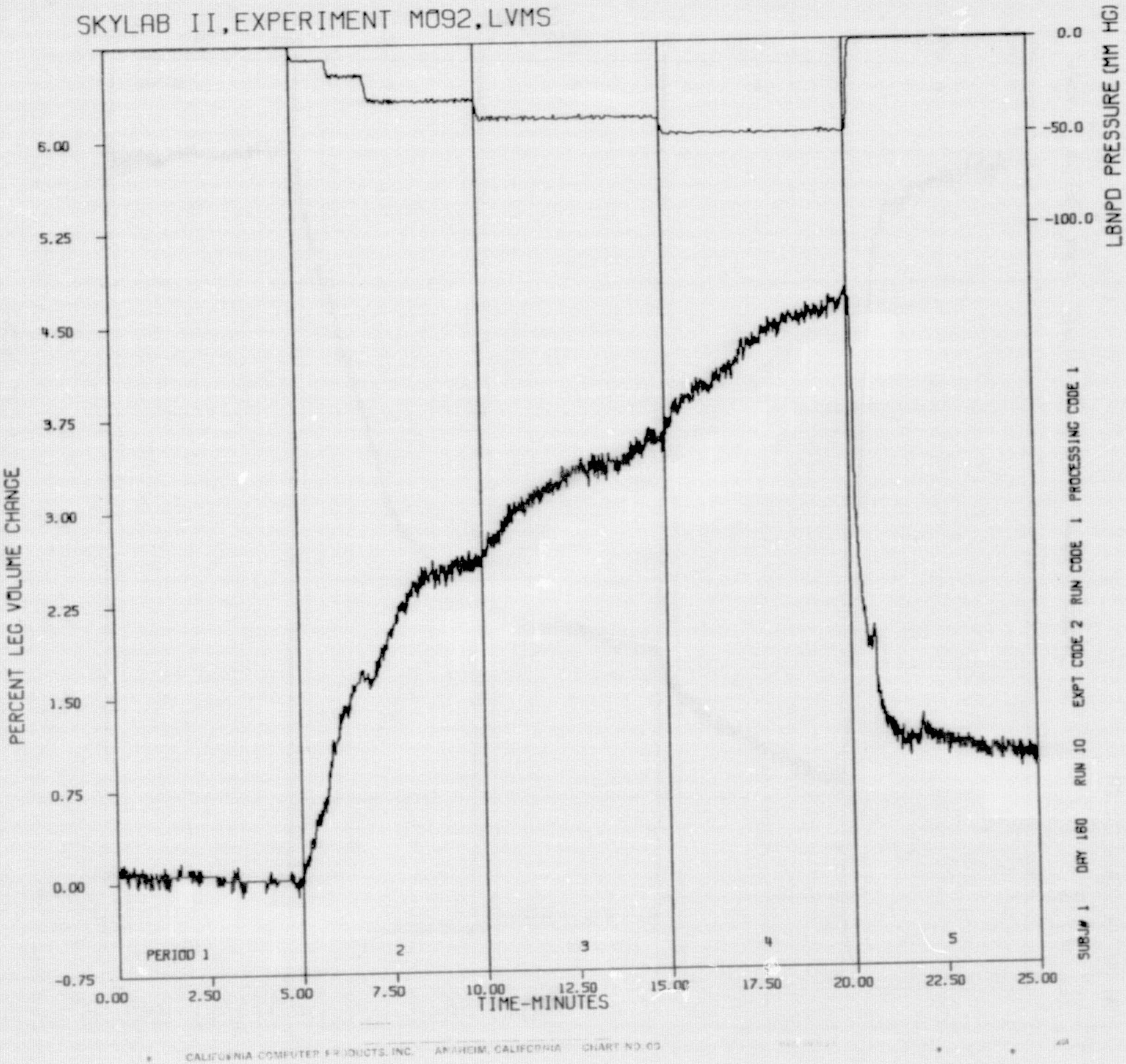

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
SUBJ# 1 DAY 149 RUN 7 EXPT CODE 2 RUN CODE 30 PROCESSING CODE 1


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 153 RUN 8 EXPT CODE 2 RUN CODE 8 PROCESSING CODE 1
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00

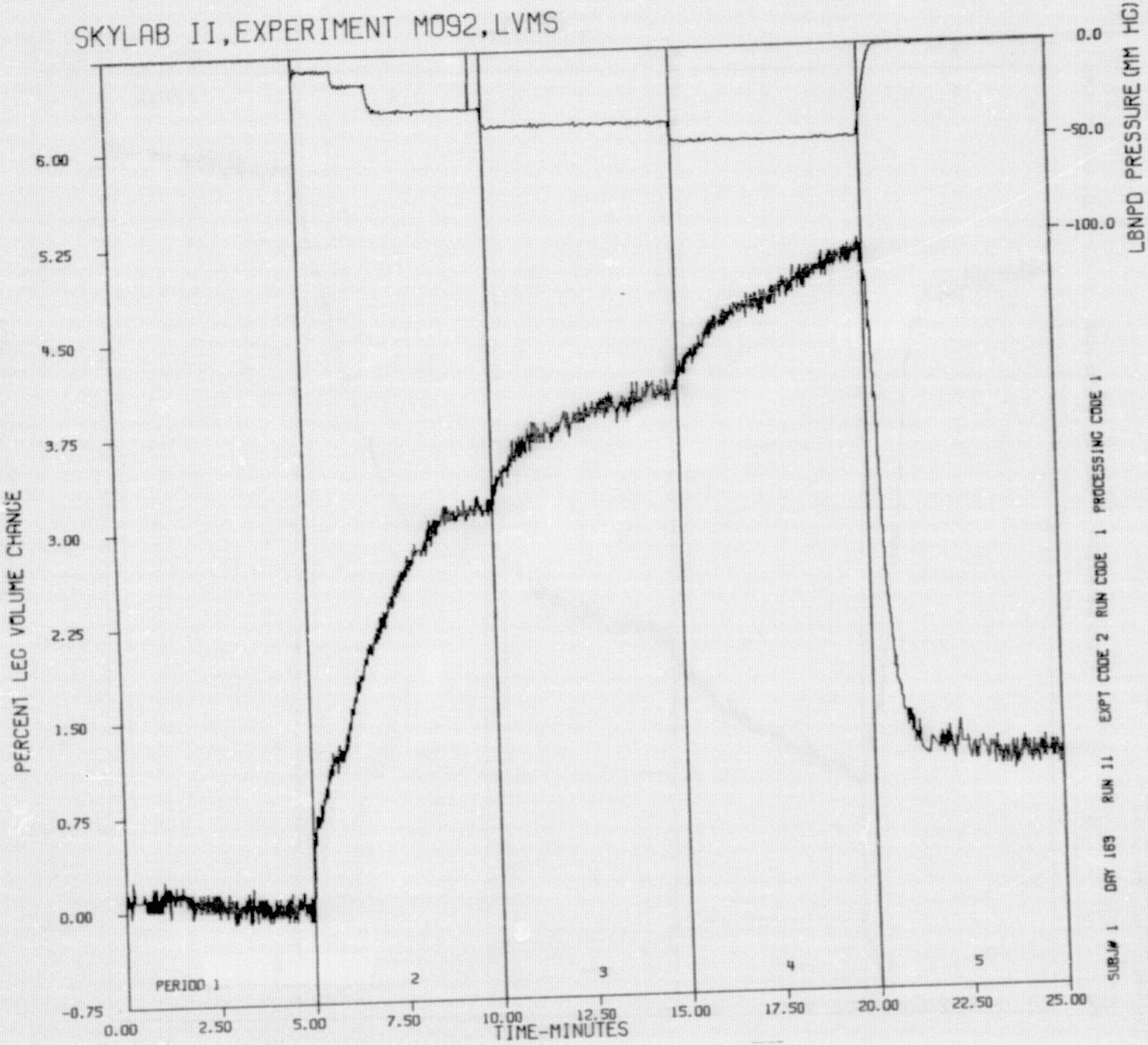


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
SUBJ# 1 DAY 158 RUN 9 EXPT CODE 2 RUN CODE 1 PROCESSING CODE 1

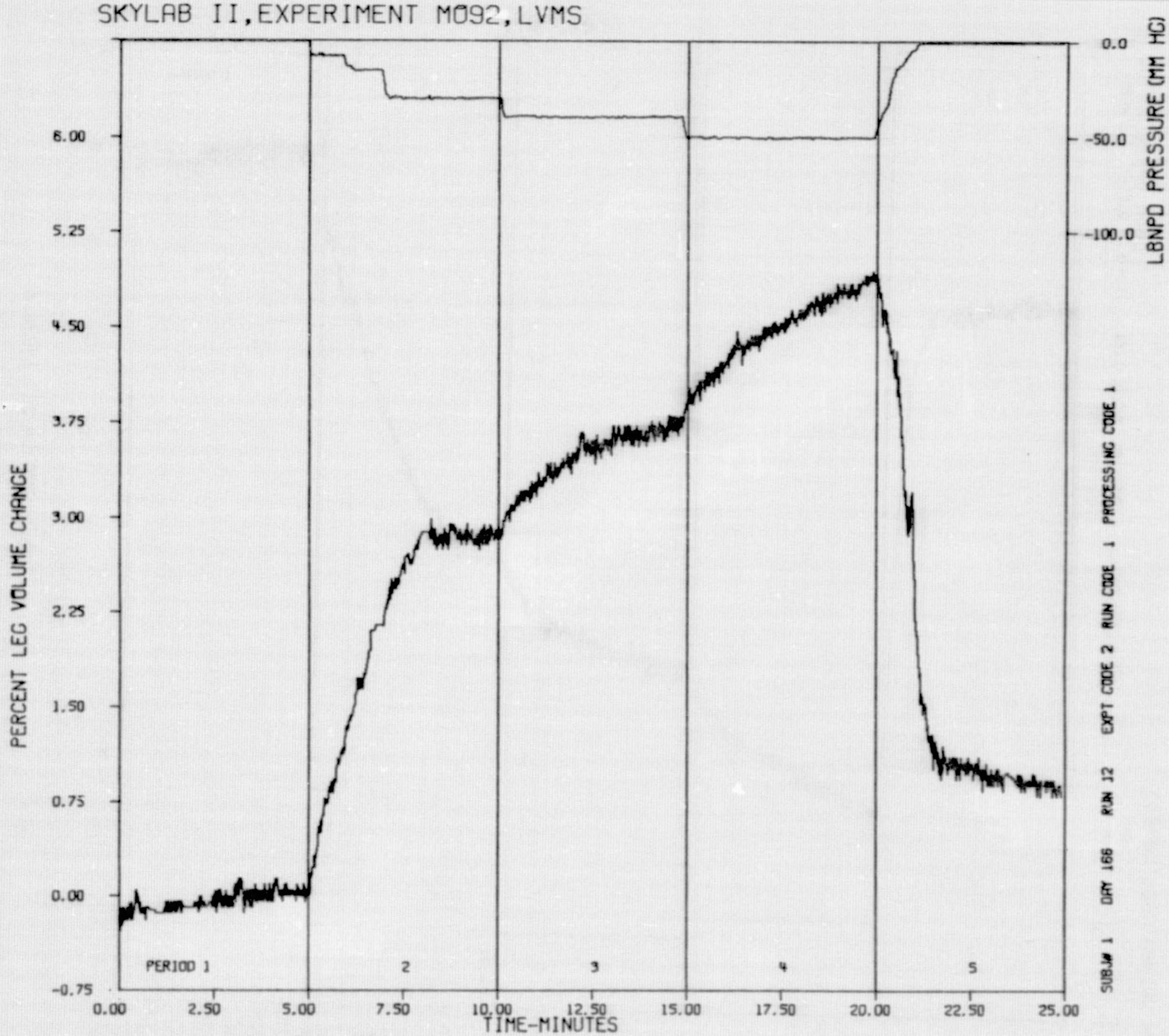
6-9



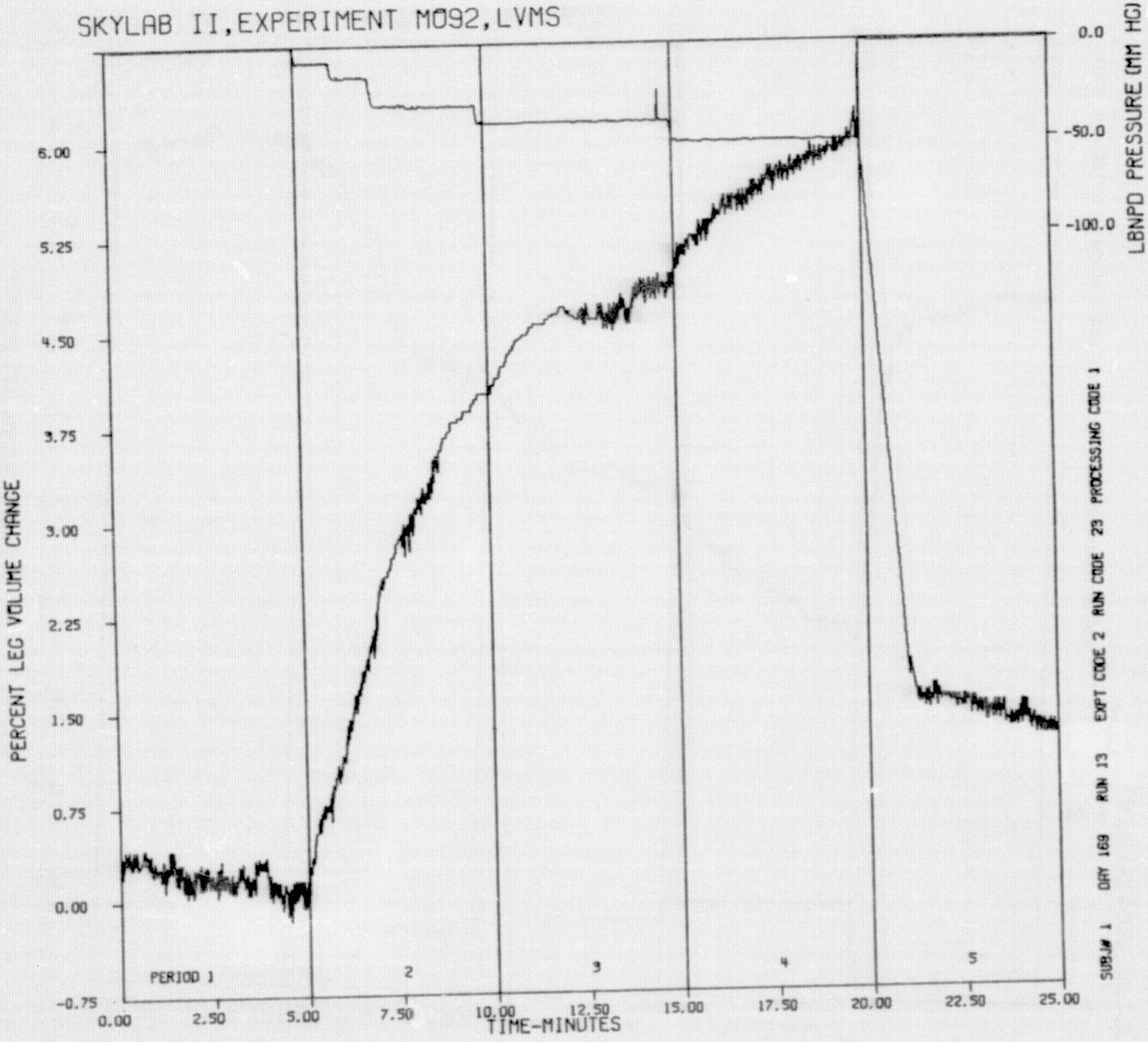
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 160 RUN 10 EXPT CODE 2 RUN CODE 1 PROCESSING CODE 1
CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CALIFORNIA CHART NO. 03

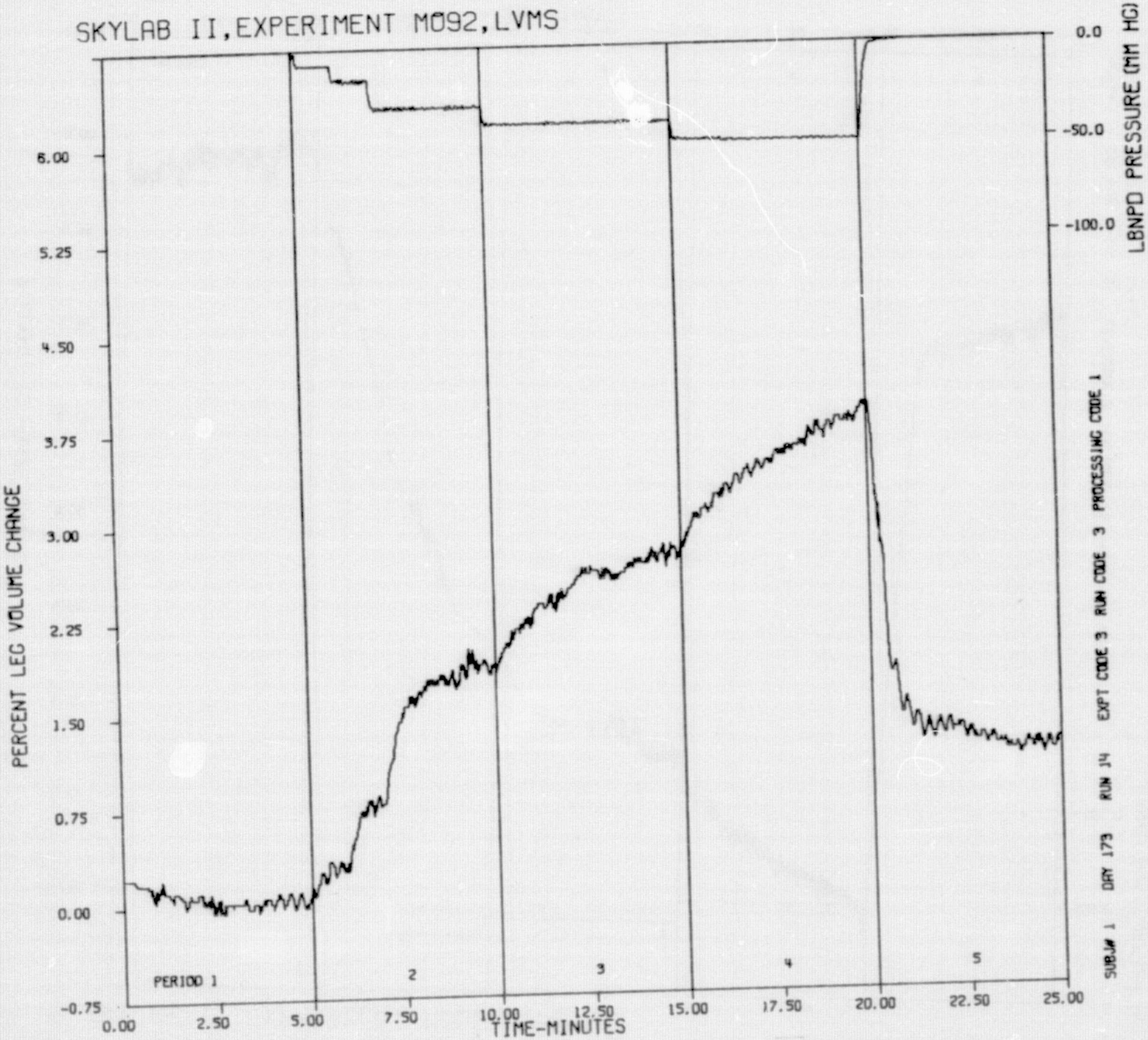


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
SUBJ# 1 DAY 163 RUN 11 EXPT CODE 2 RUN CODE 1 PROCESSING CODE 1

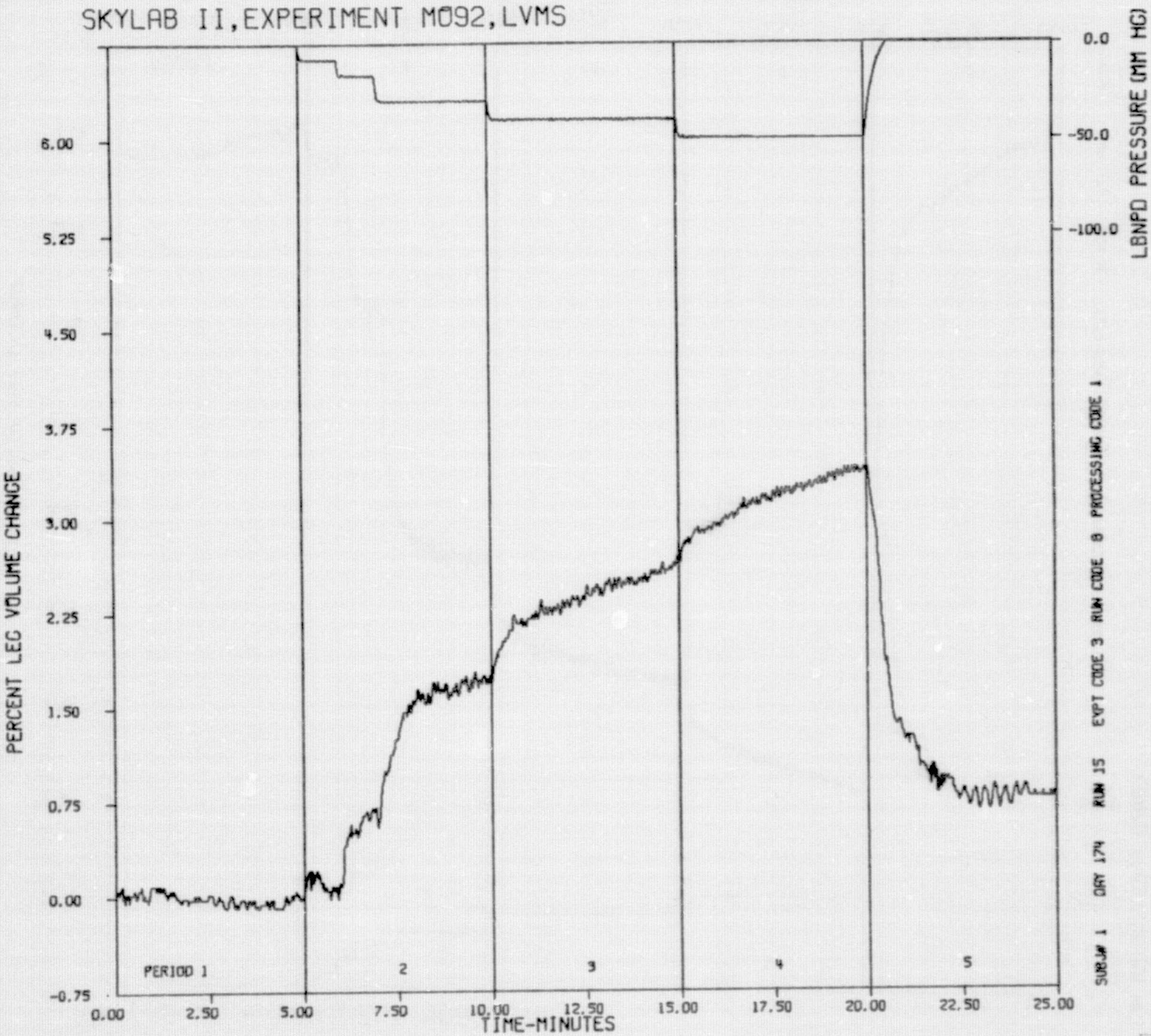

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
-0.75
0.75
1.50
2.25
3.00
3.75
4.50
5.25
6.00
0.0
-50.0
-100.0
SUBJ# 1 DAY 166 RUN 12 EXPT CODE 2 RUN CODE 1 PROCESSING CODE 1

D-12

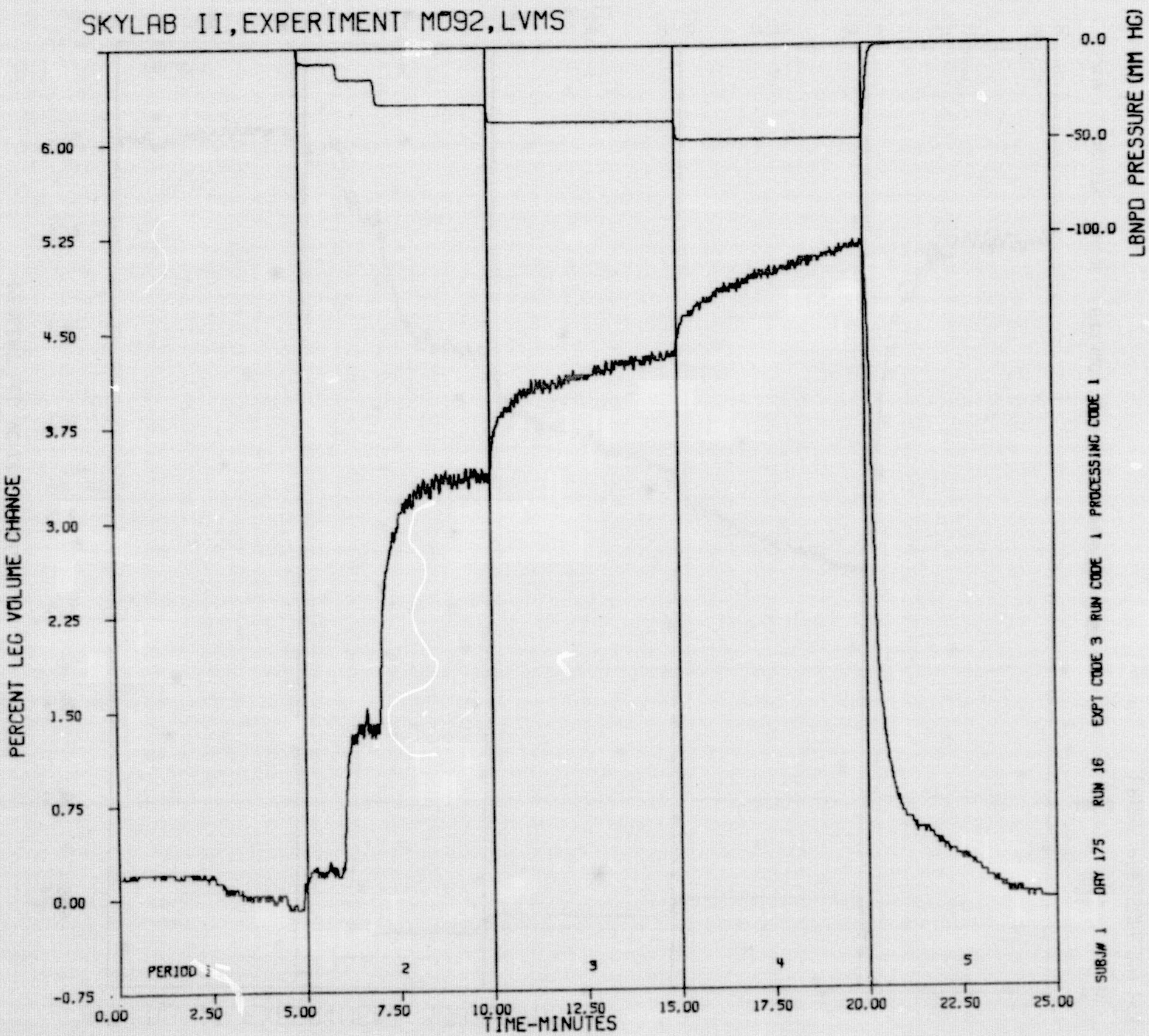

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 169 RUN 13 EXPT CODE 2 RUN CODE 23 PROCESSING CODE 1



SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 173 RUN 14 EXPT CODE 3 RUN CODE 3 PROCESSING CODE 1
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00

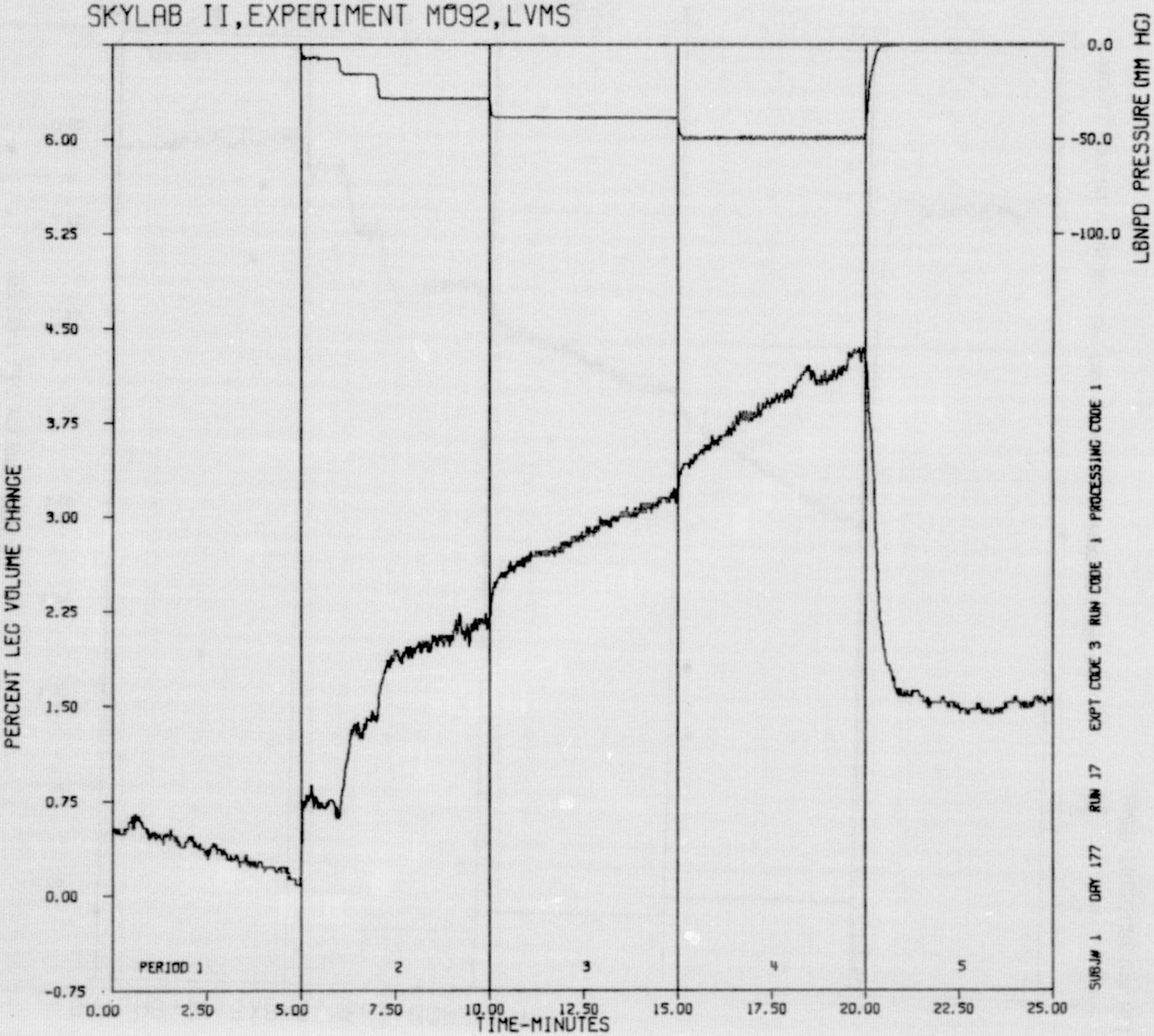

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 174 RUN 15 EXPT CODE 3 RUN CODE 8 PROCESSING CODE 1

C-3



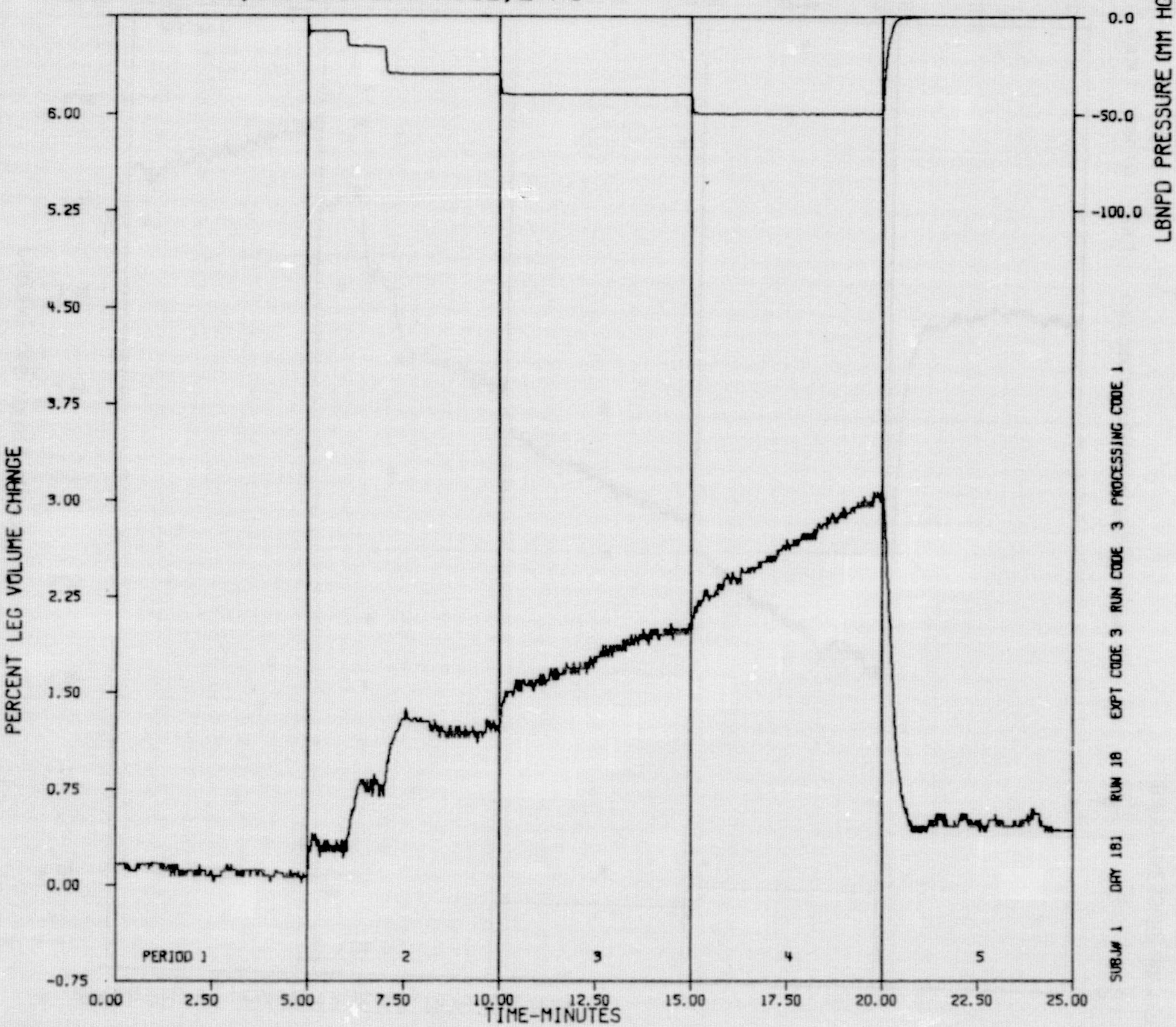
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
SUBJ# 1 DAY 175 RUN 16 EXPT CODE 3 RUN CODE 1 PROCESSING CODE 1

D-16

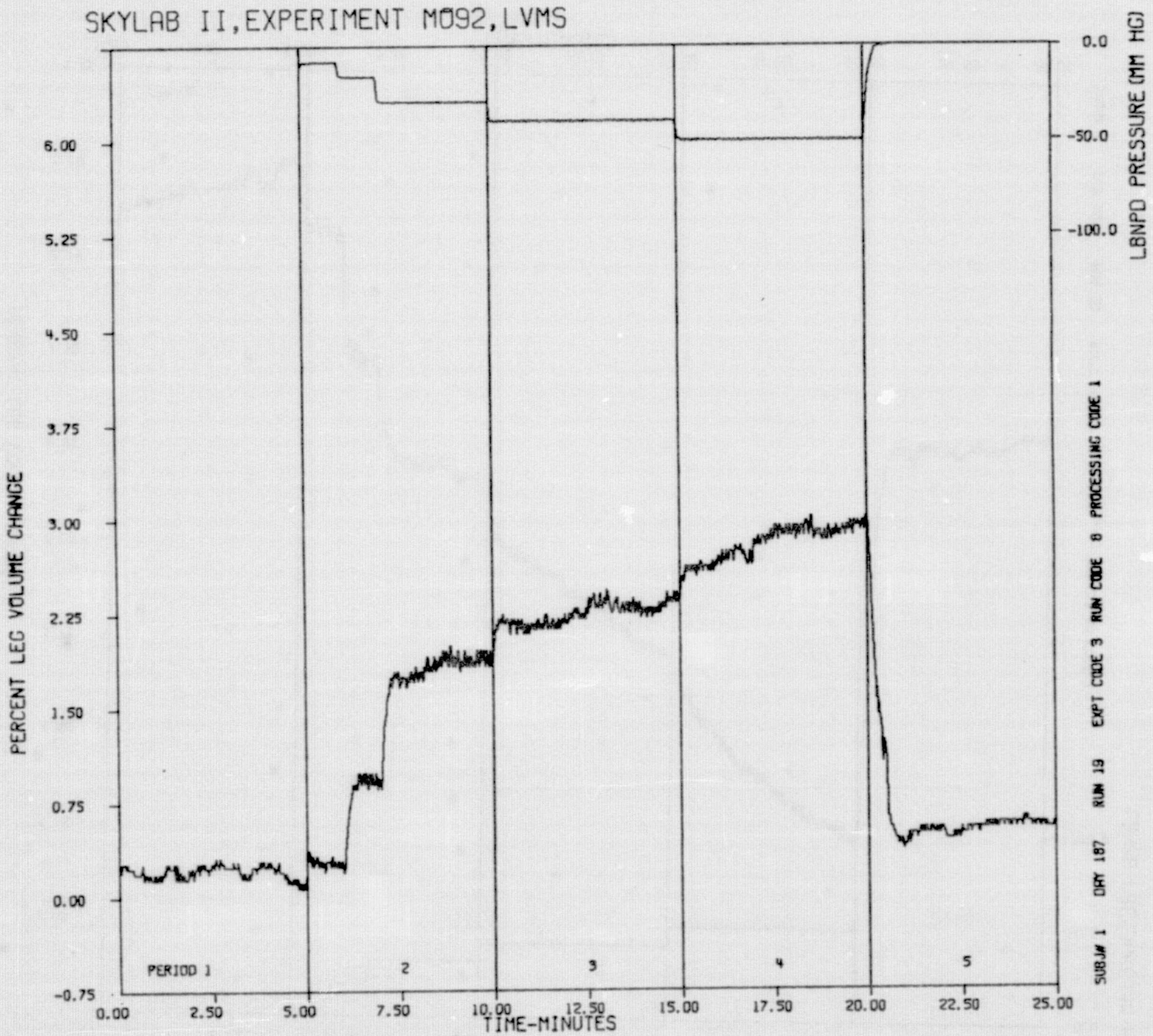


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
SUBJ# 1 DAY 177 RUN 17 EXPT CODE 3 RUN CODE 1 PROCESSING CODE 1

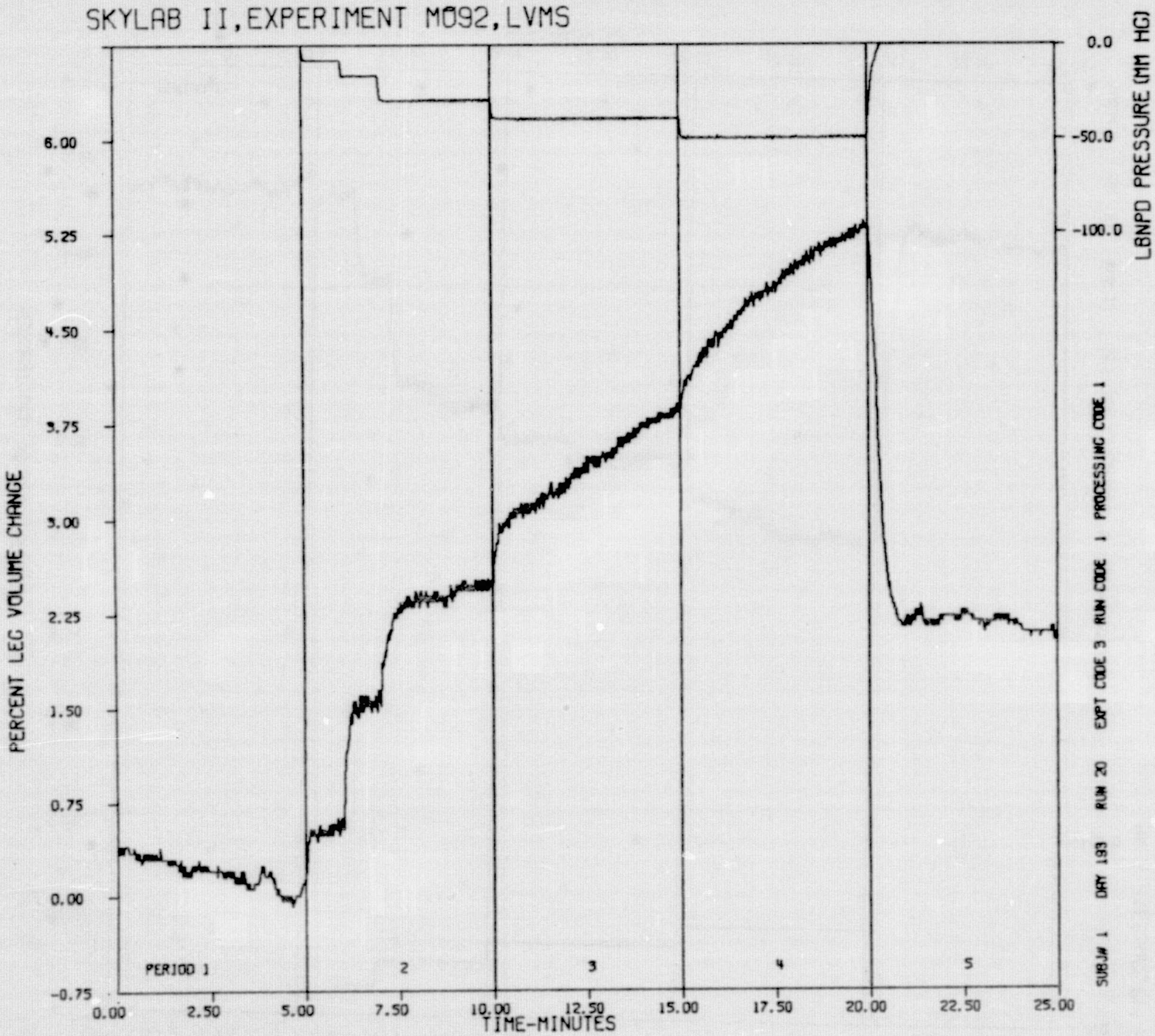
SKYLAB II, EXPERIMENT M092, LVMS

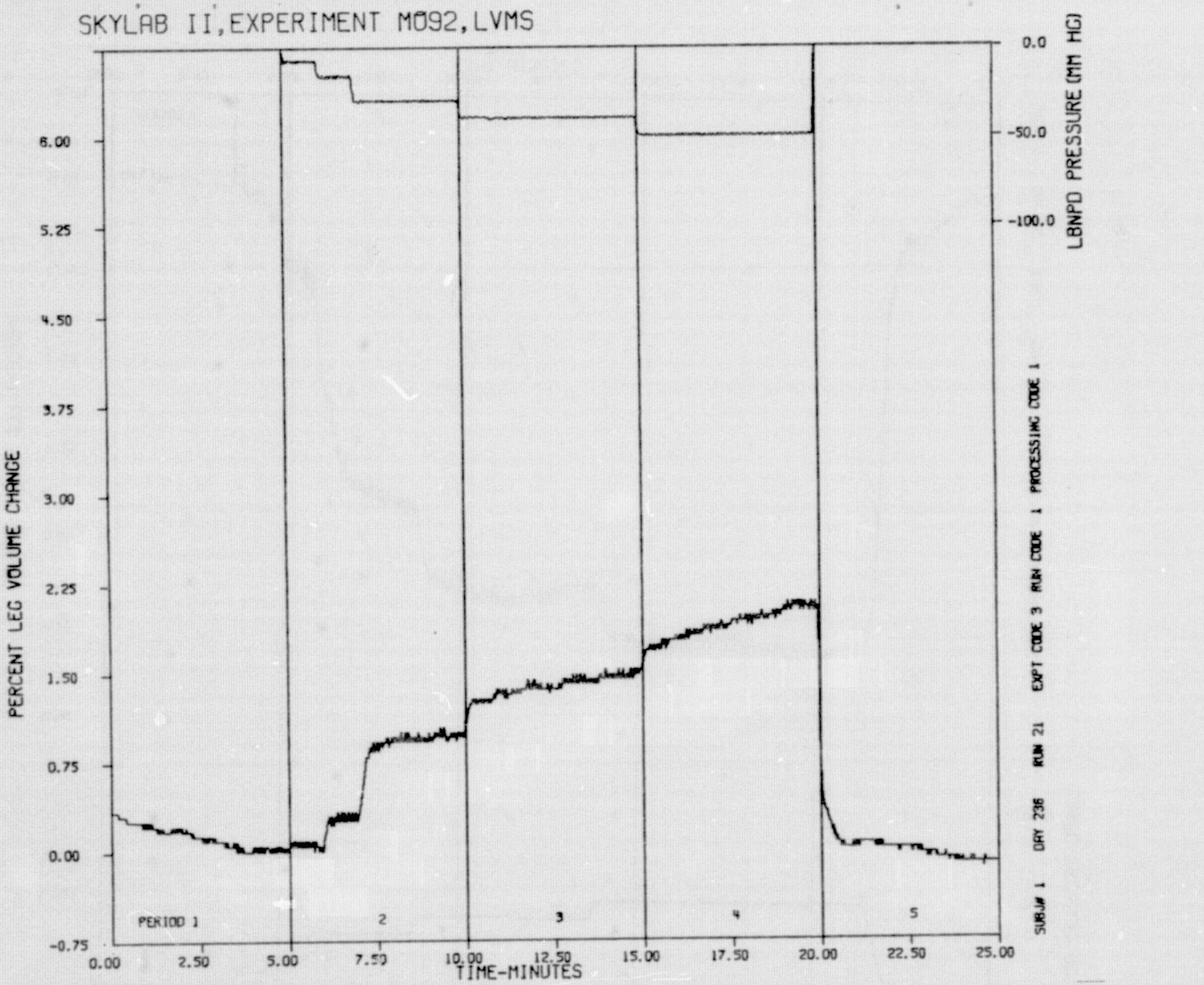


D-18

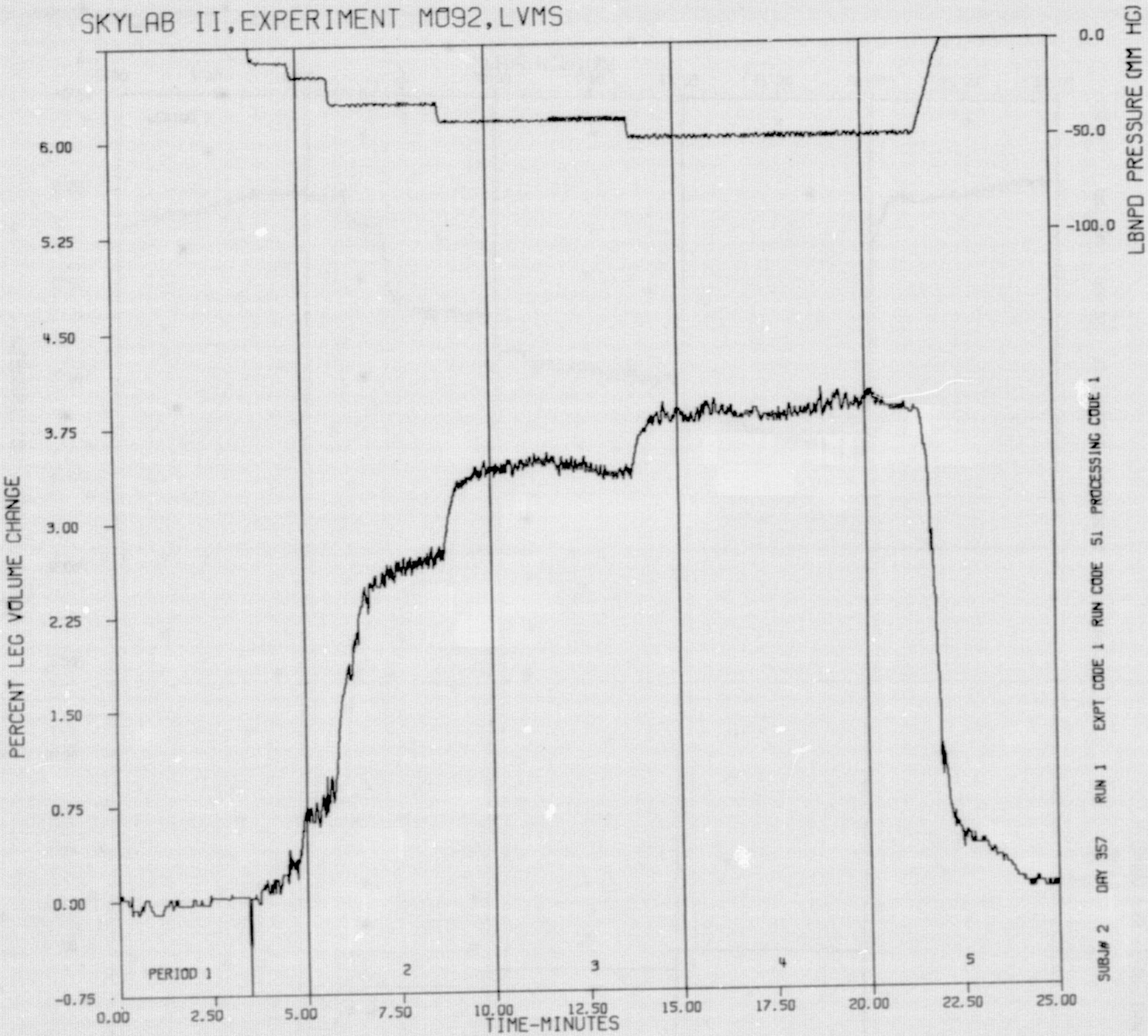


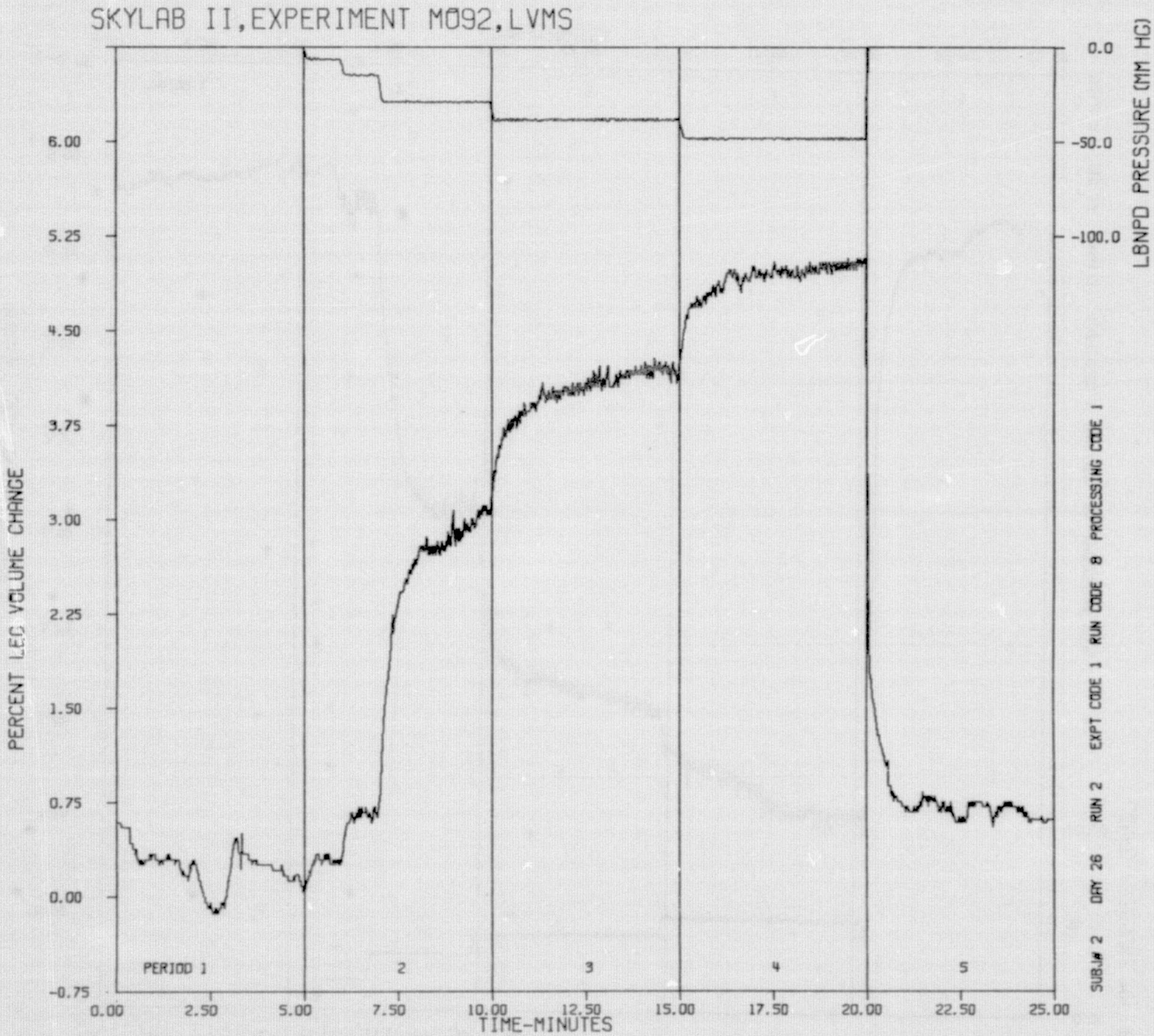
CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CALIFORNIA CHART NO. CO


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 193 RUN 20 EXPT CODE 3 RUN CODE 1 PROCESSING CODE 1



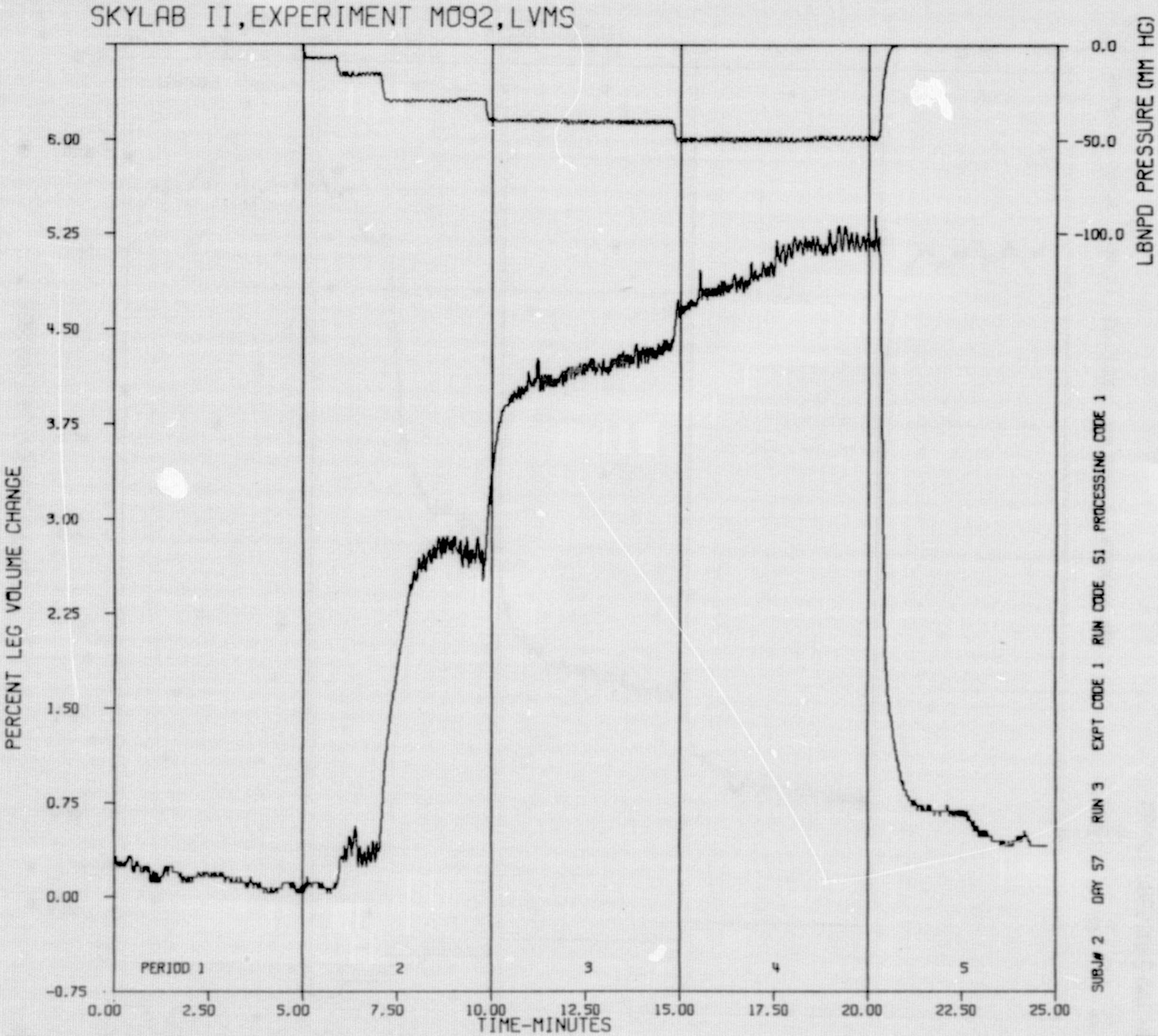
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
TIME-MINUTES
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 1 DAY 236 RUN 21 EXPT CODE 3 RUN CODE 1 PROCESSING CODE 1
CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, C


SKYLAB II, EXPERIMENT M092, LVMS
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
TIME-MINUTES
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 357 RUN 1 EXPT CODE 1 RUN CODE 51 PROCESSING CODE 1



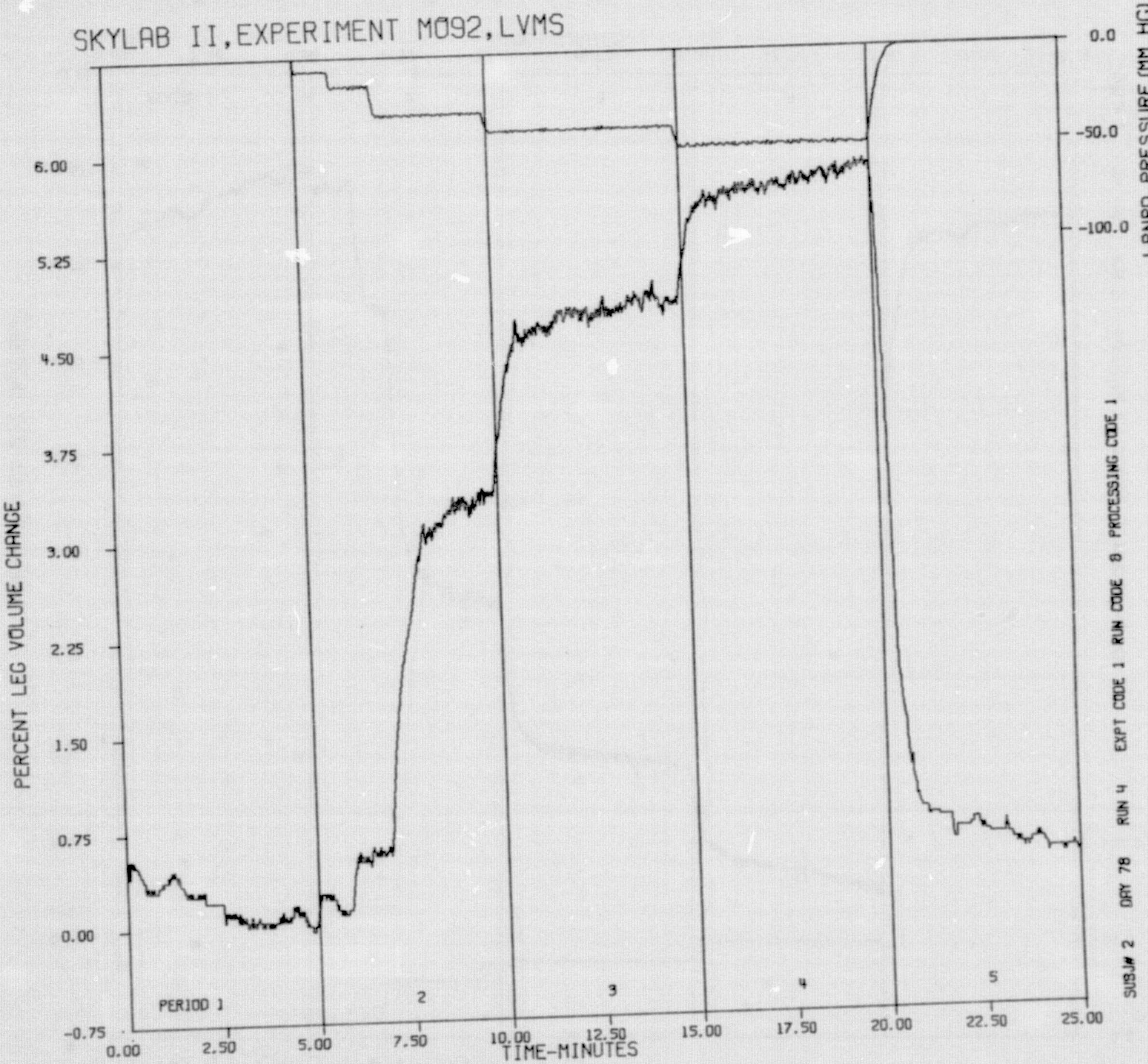
D-23

CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CALIFORNIA CHART NO. 00

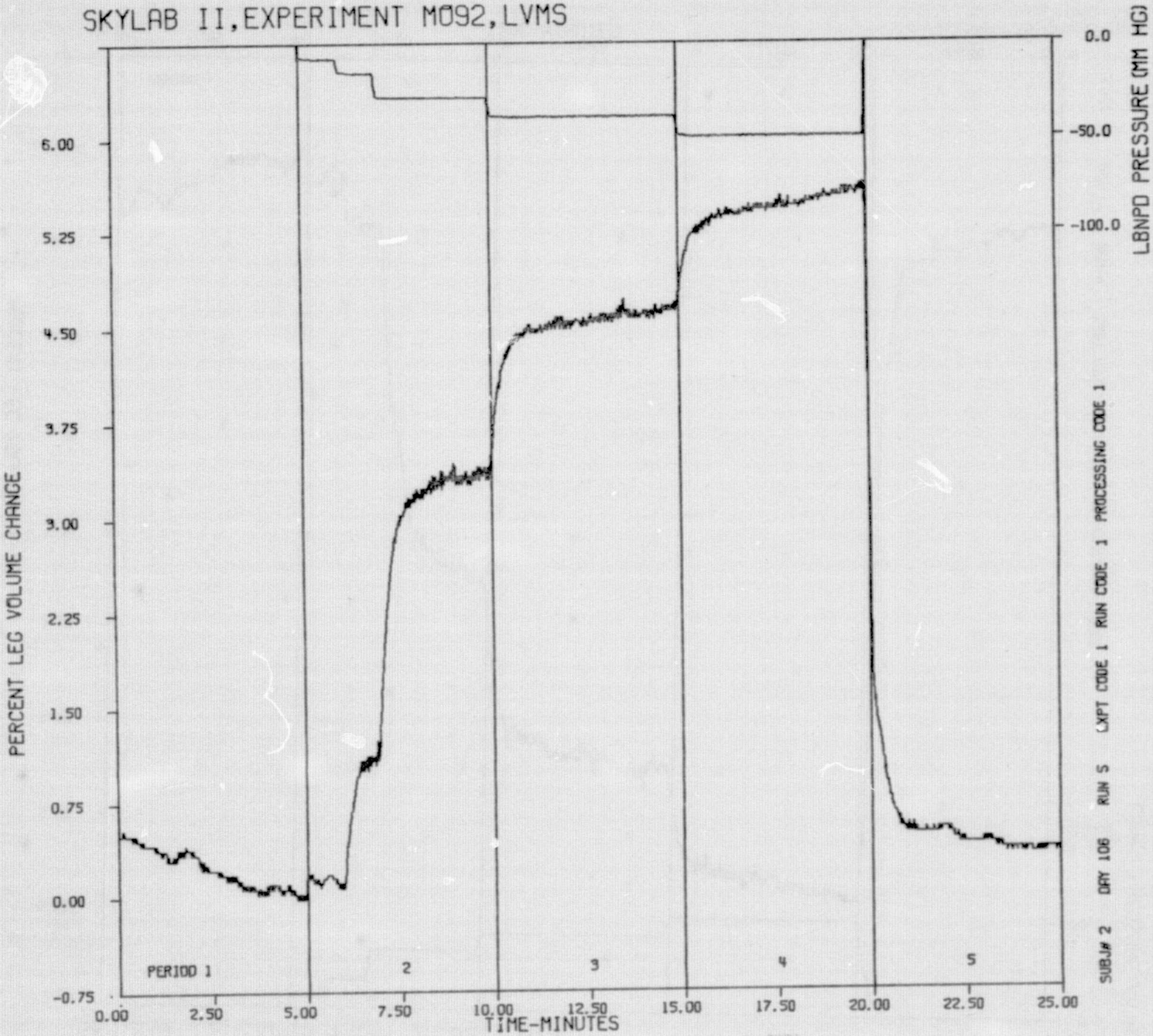


D-24

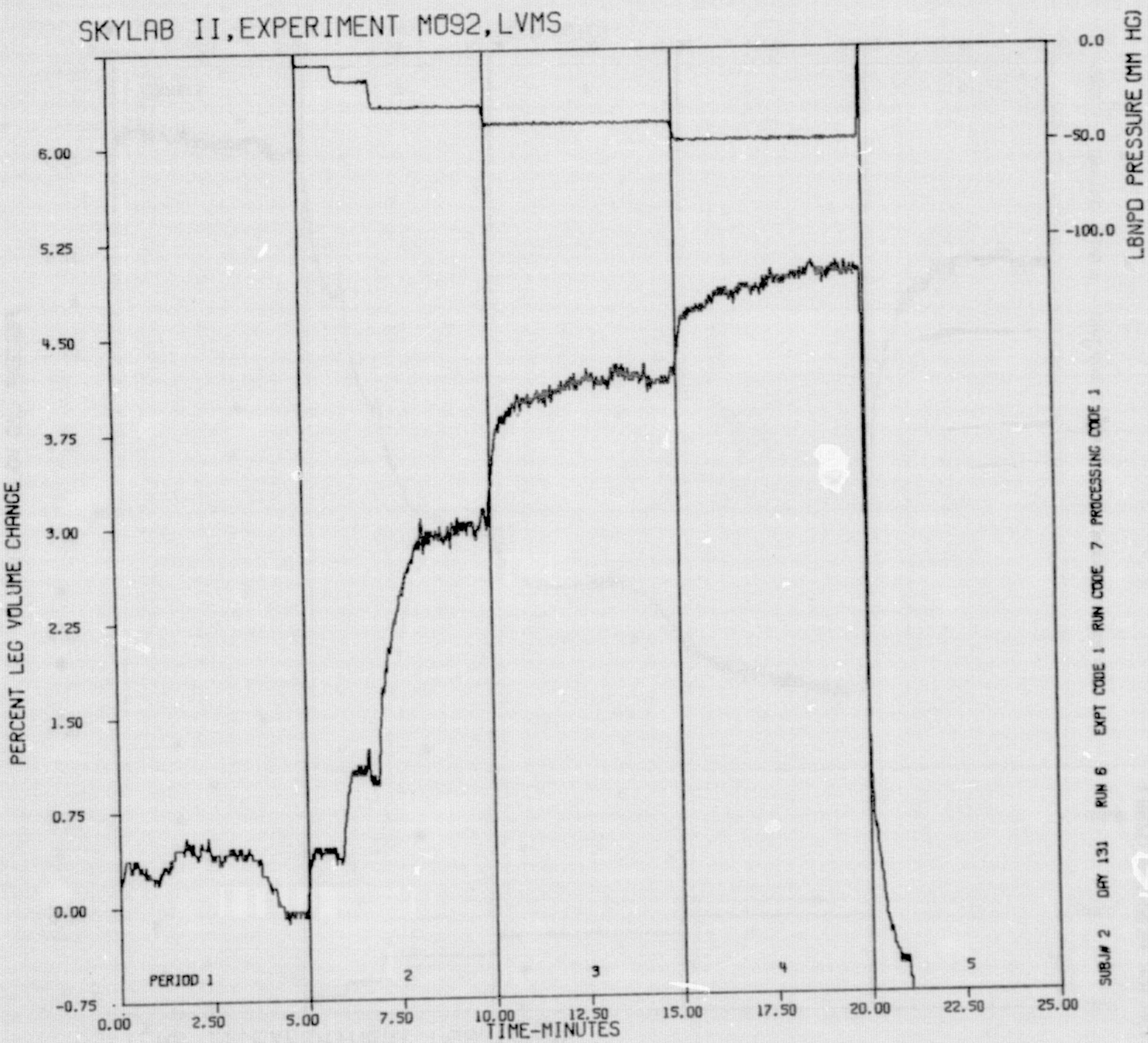
CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CA



SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
LBNPD PRESSURE (MM HG)
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
SUBJ# 2 DAY 78 RUN 4 EXPT CODE 1 RUN CODE 8 PROCESSING CODE 1

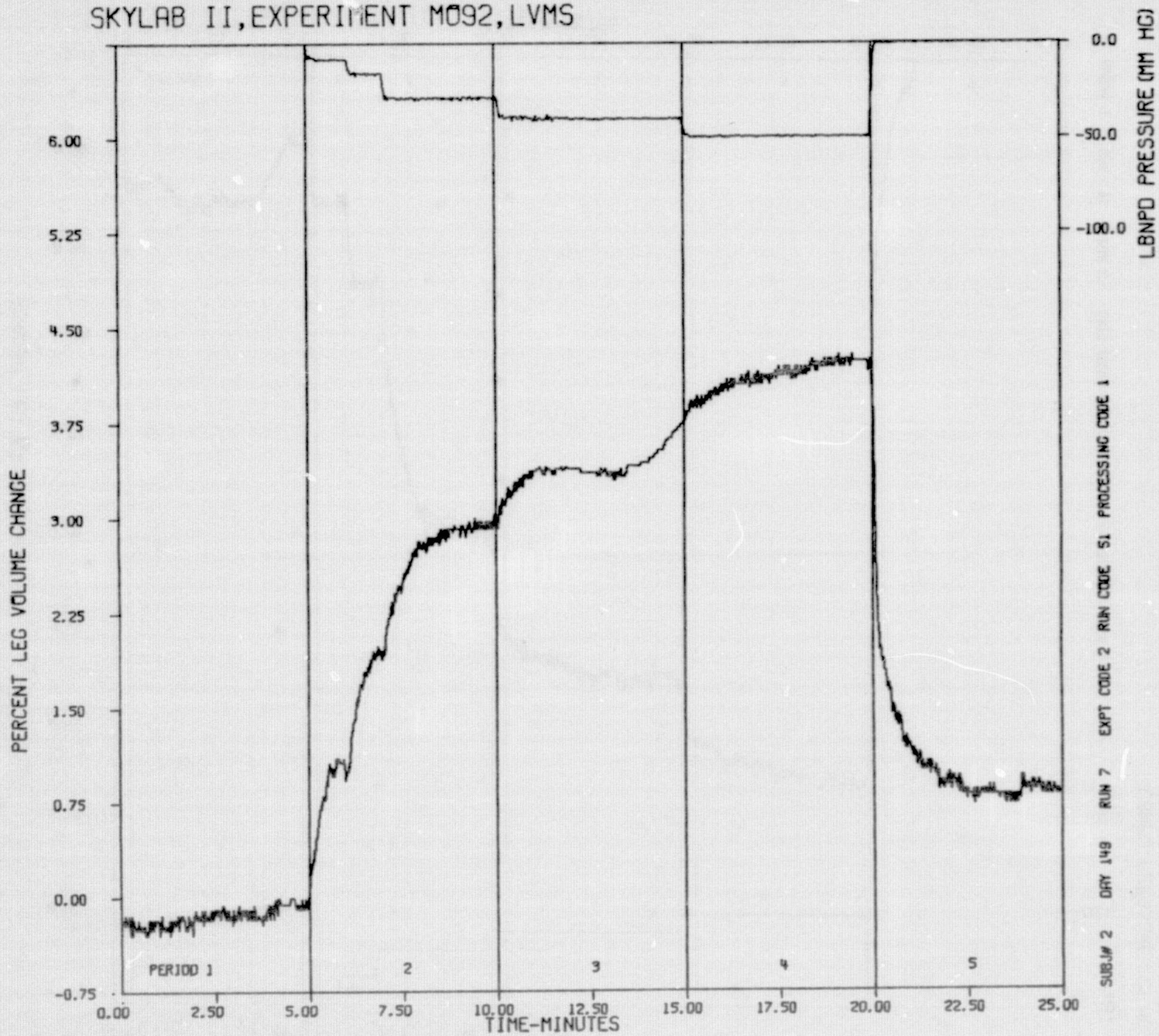

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 106 RUN S LXPT CODE 1 RUN CODE 1 PROCESSING CODE 1

D-26



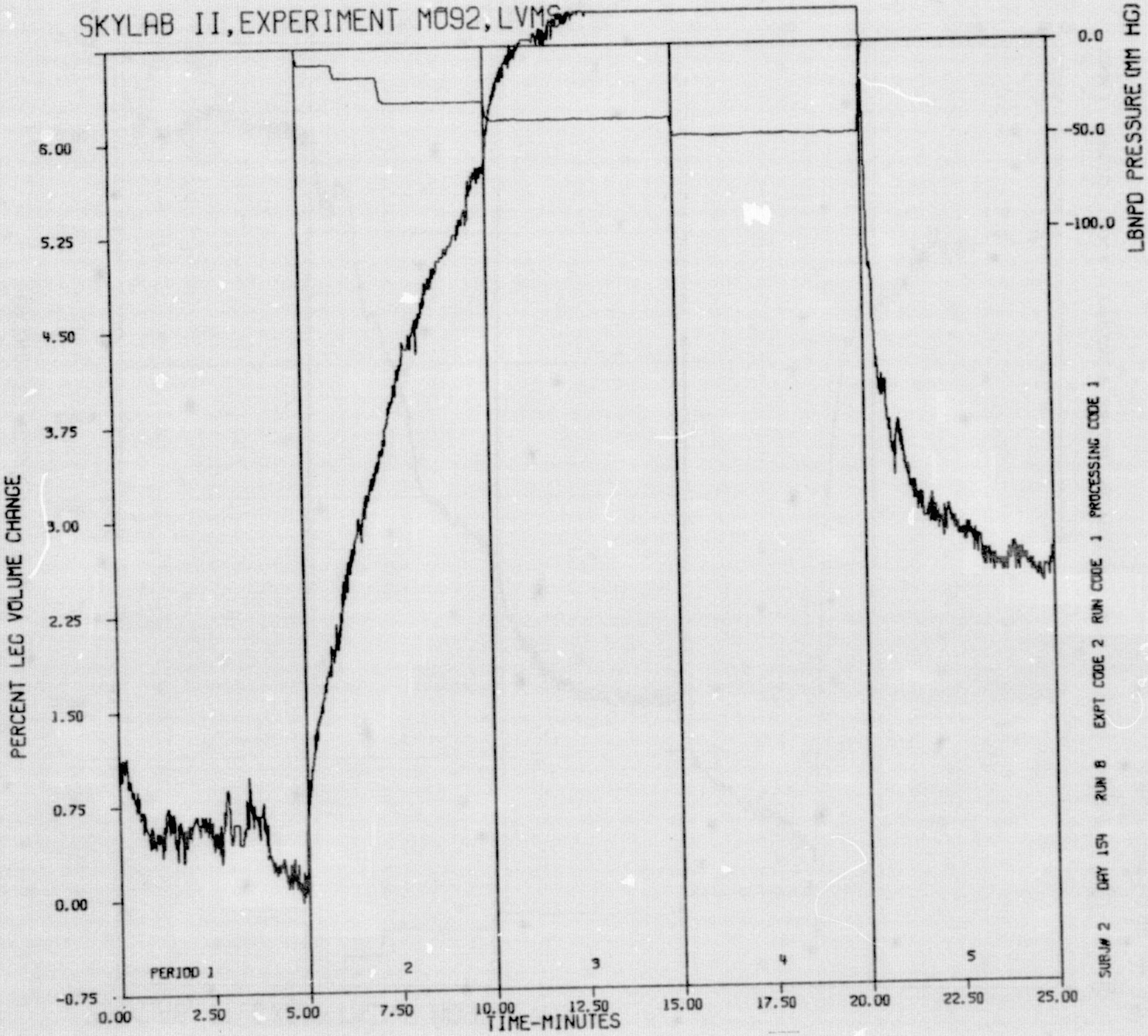
D-27

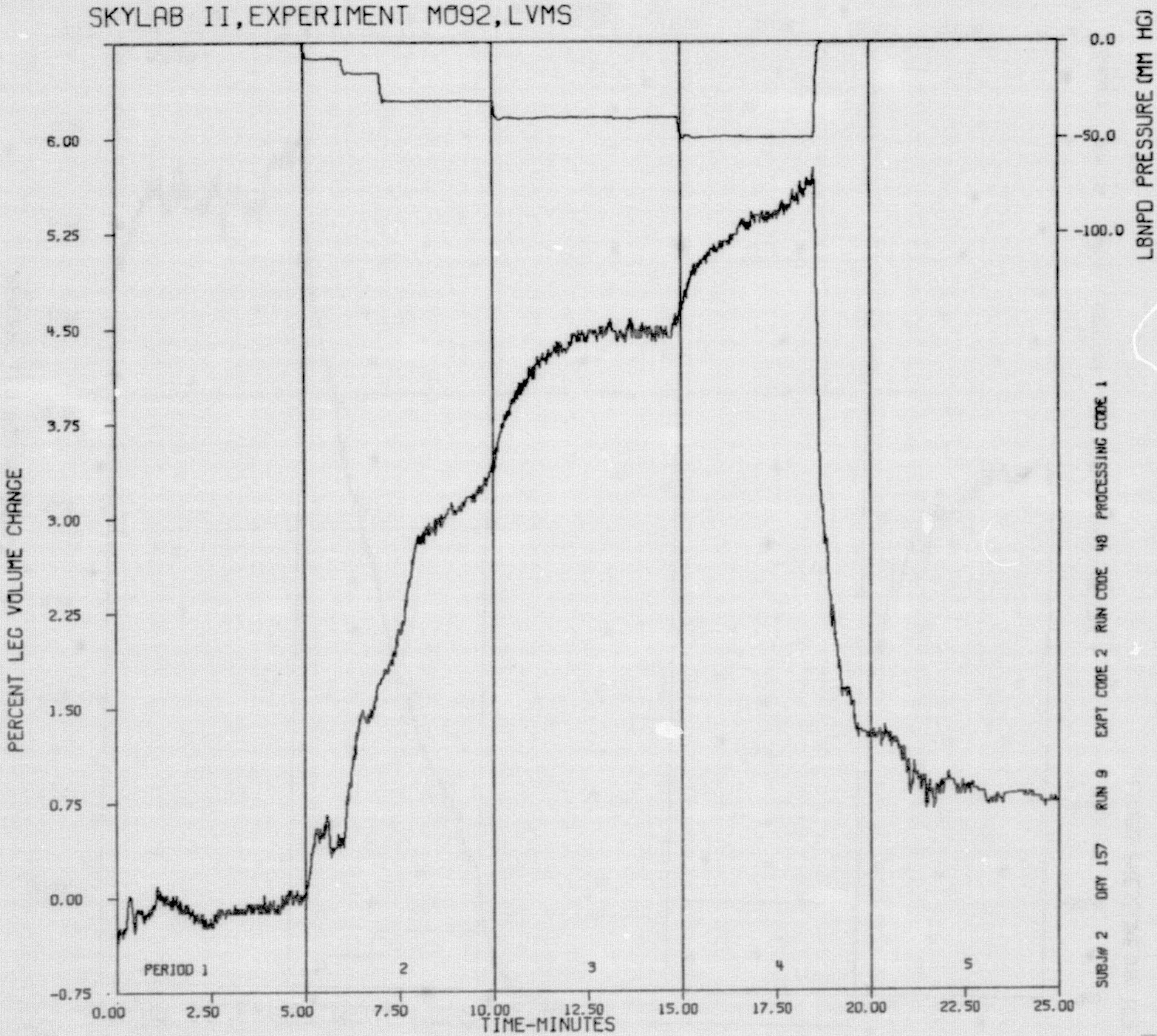
CALIFORNIA COMPUTER PRODUCTS INC. ANAHEIM, CA

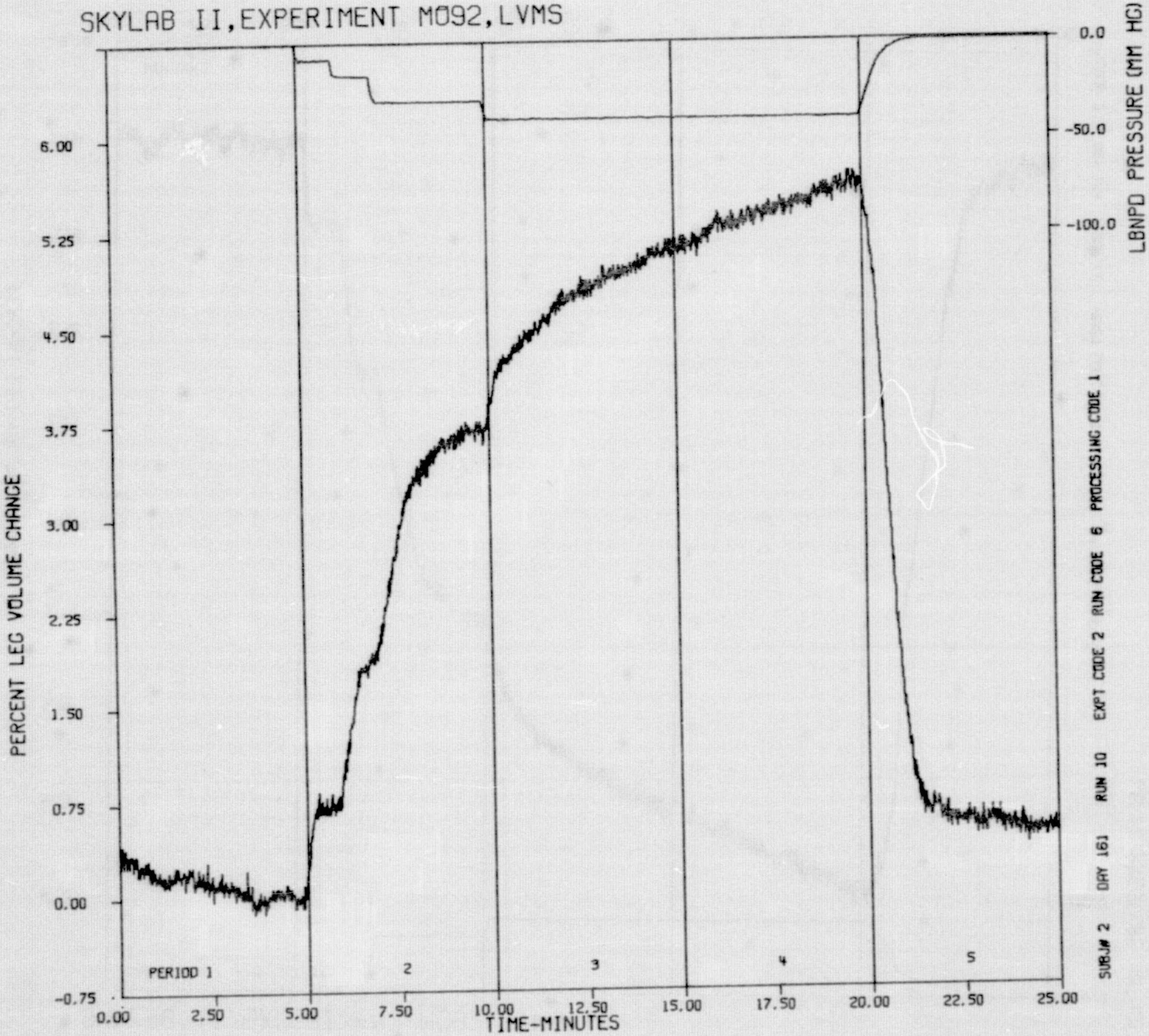


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
SUBJ# 2 DAY 149 RUN 7 EXPT CODE 2 RUN CODE 51 PROCESSING CODE 1

D-28

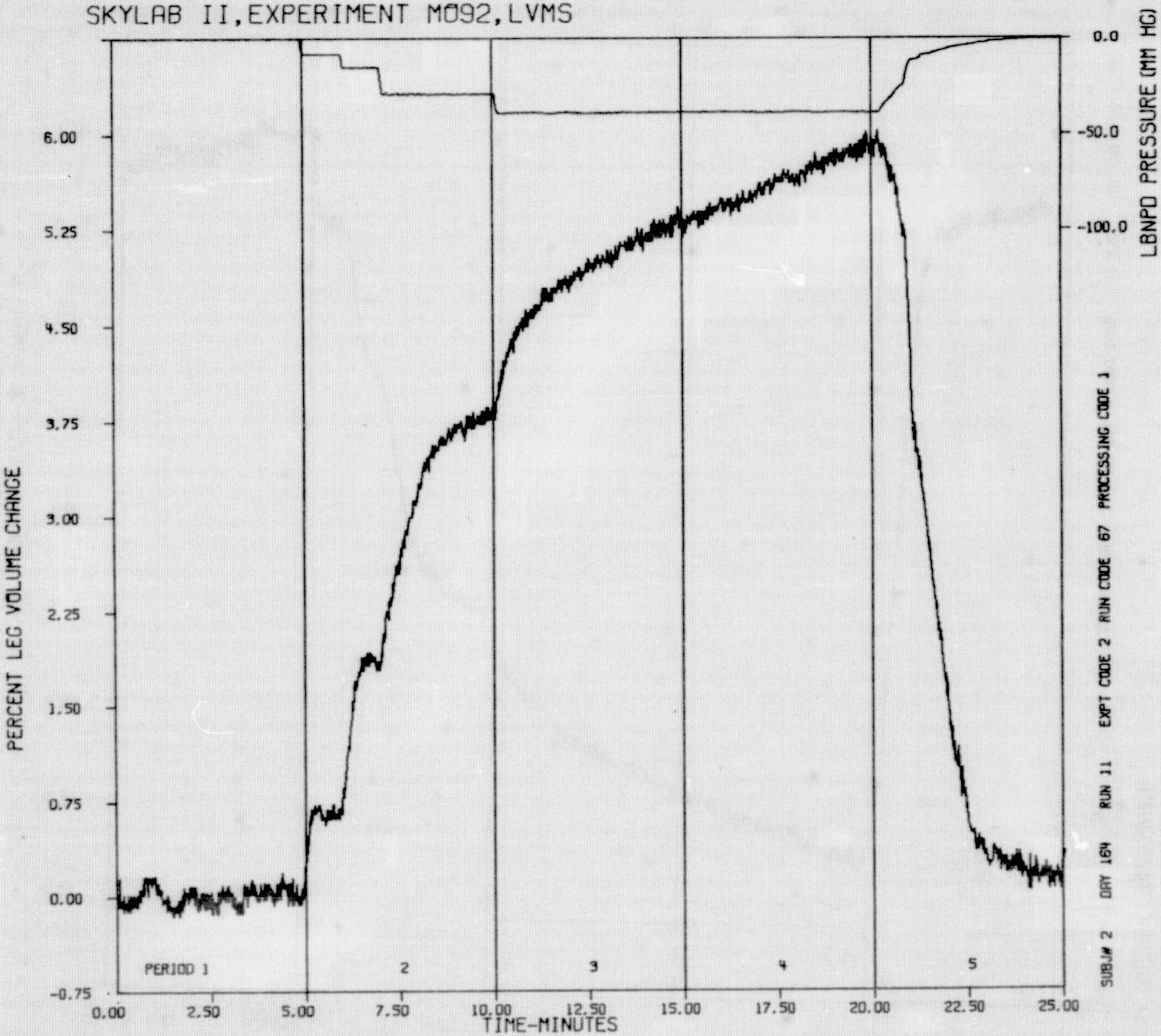

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 154 RUN 8 EXPT CODE 2 RUN CODE 1 PROCESSING CODE 1

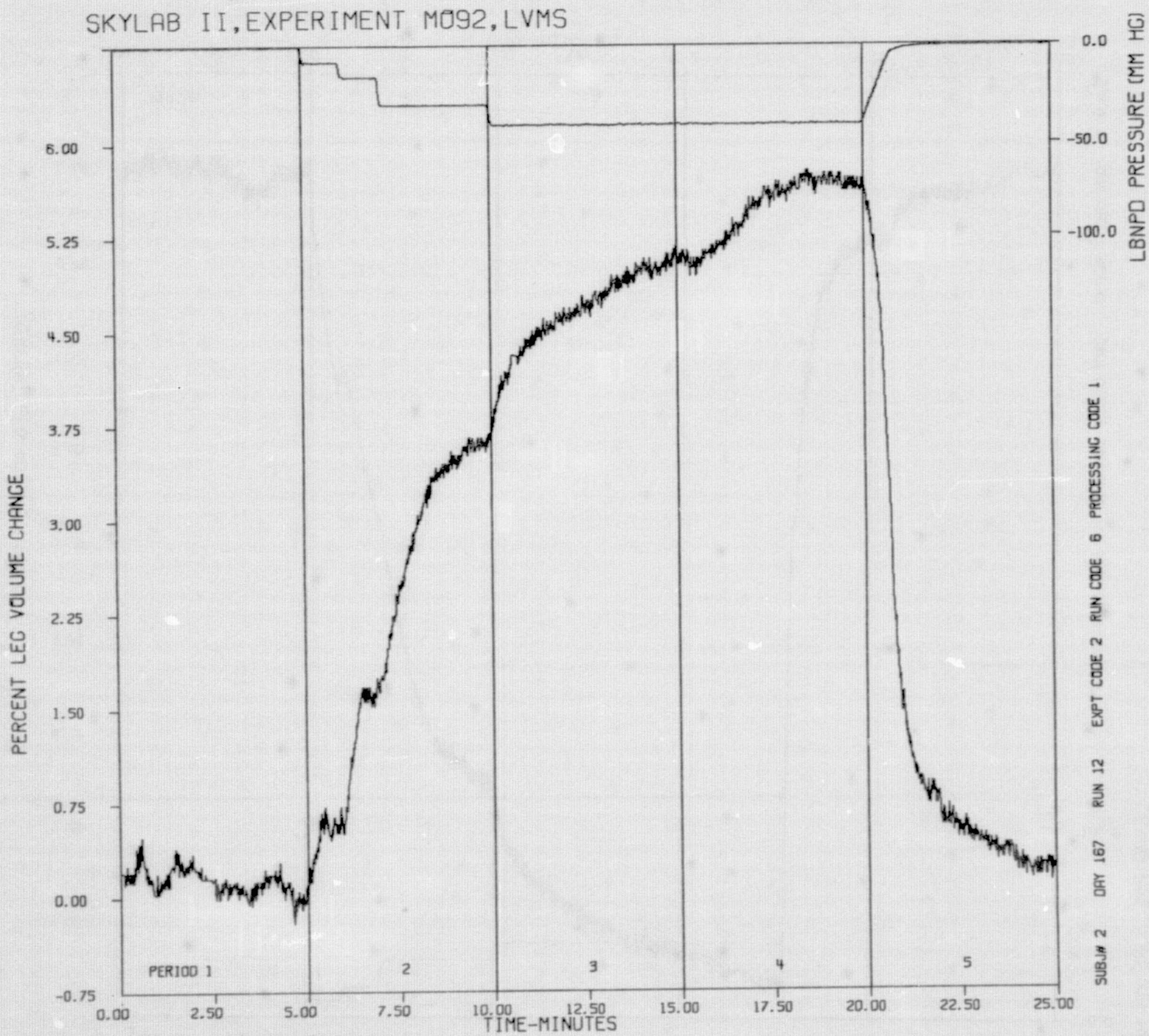

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
SUBJ# 2 DAY 157 RUN 9 EXPT CODE 2 RUN CODE 48 PROCESSING CODE 1



SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
SUBJ# 2 DAY 161 RUN 10 EXPT CODE 2 RUN CODE 6 PROCESSING CODE 1

D-31


SKYLAB II, EXPERIMENT MØ92, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 164 RUN 11 EXPT CODE 2 RUN CODE 67 PROCESSING CODE 1



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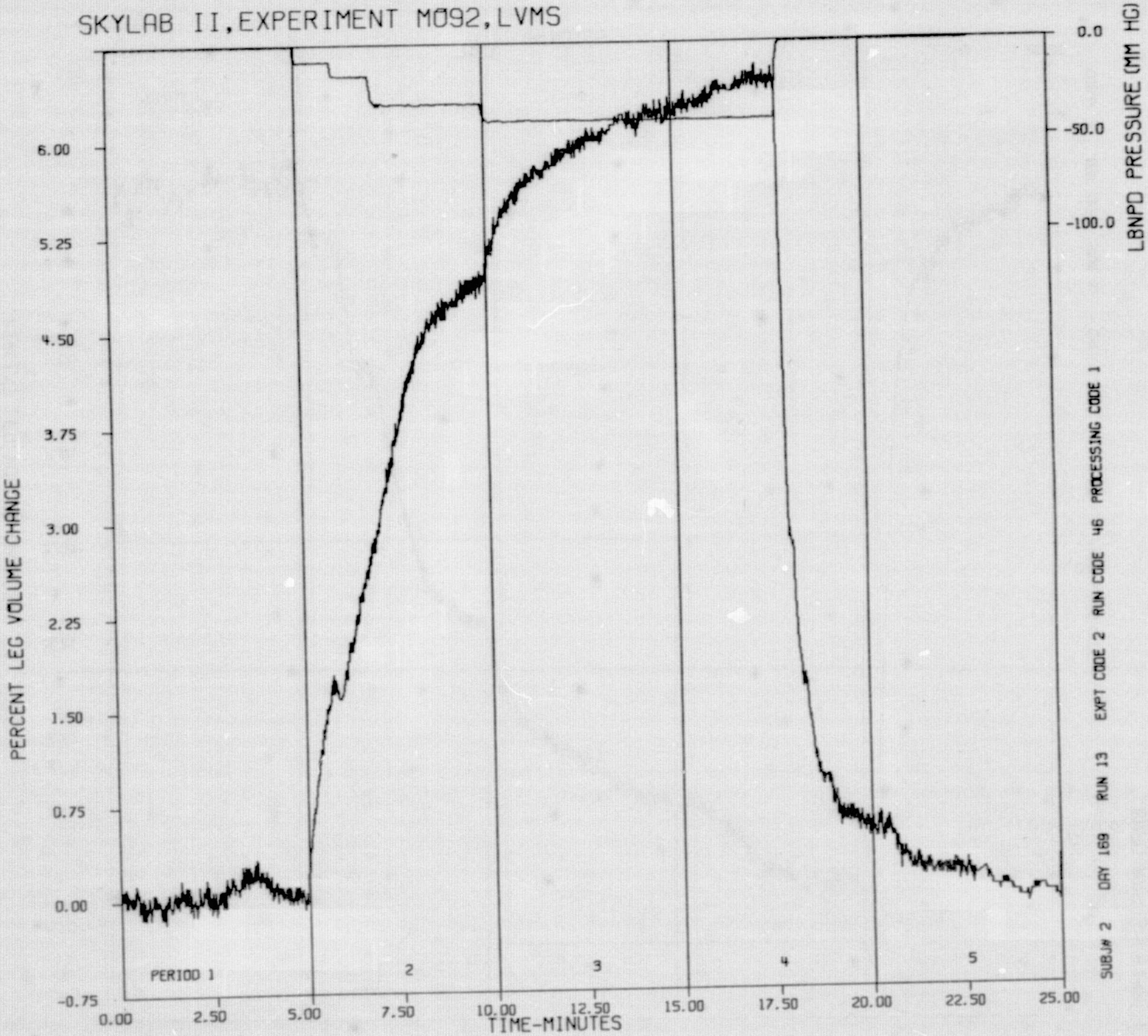
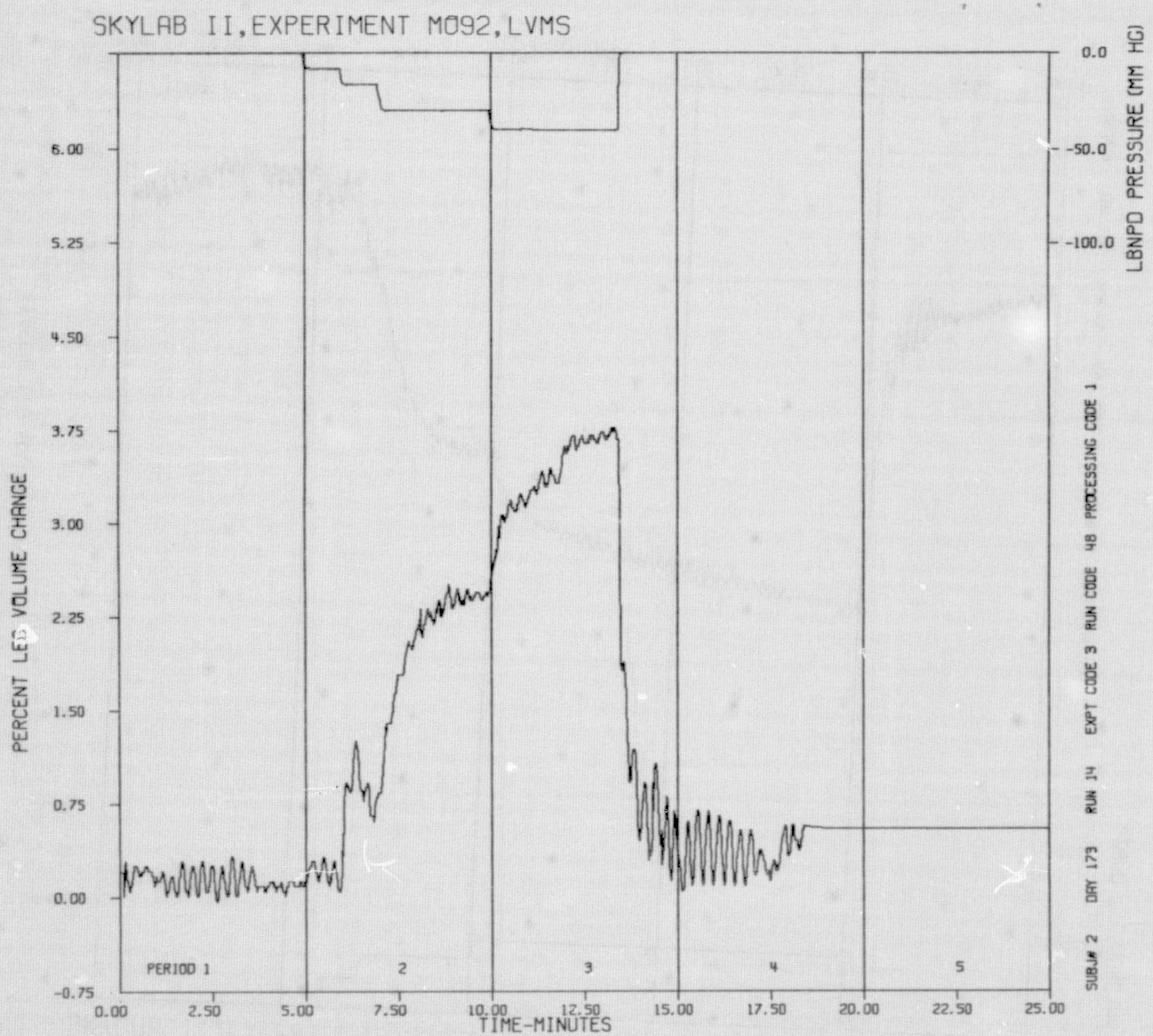
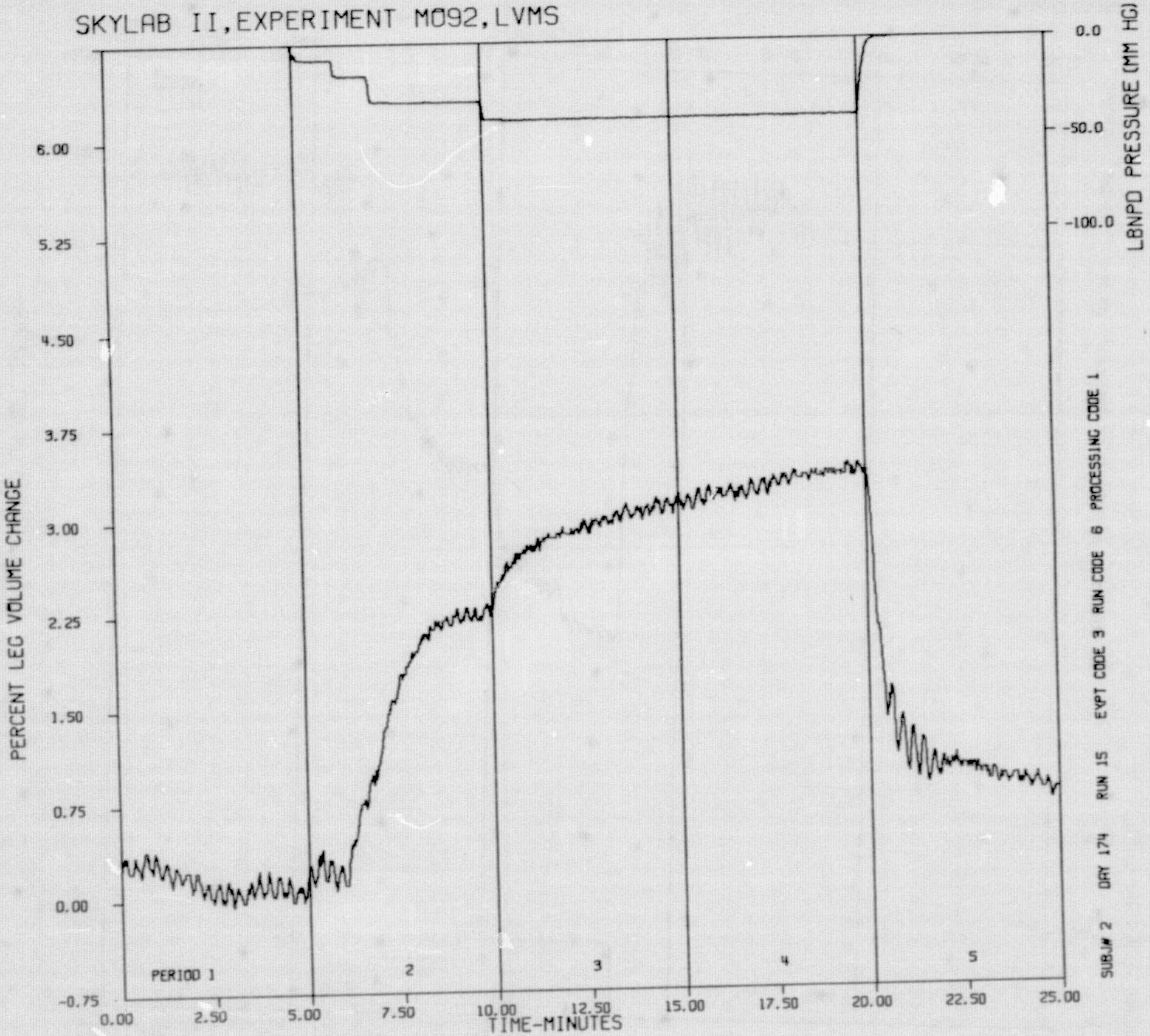
CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CALIFORNIA CHART NO. 00

CALIFORNIA COMPUTER PRC


SKYLAB II, EXPERIMENT MØ92, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 169 RUN 13 EXPT CODE 2 RUN CODE 46 PROCESSING CODE 1

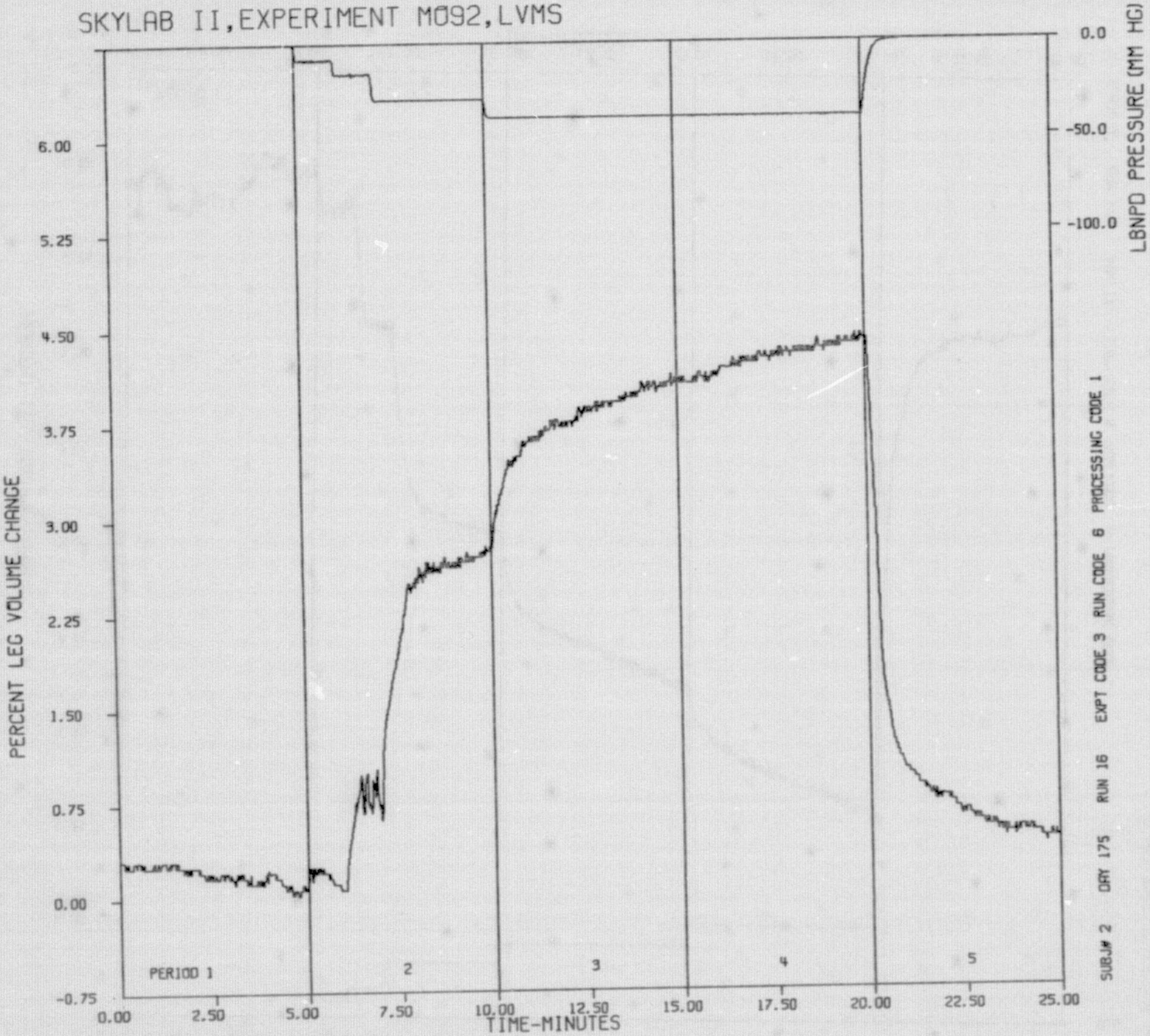

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 173 RUN 14 EXPT CODE 3 RUN CODE 48 PROCESSING CODE 1
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00

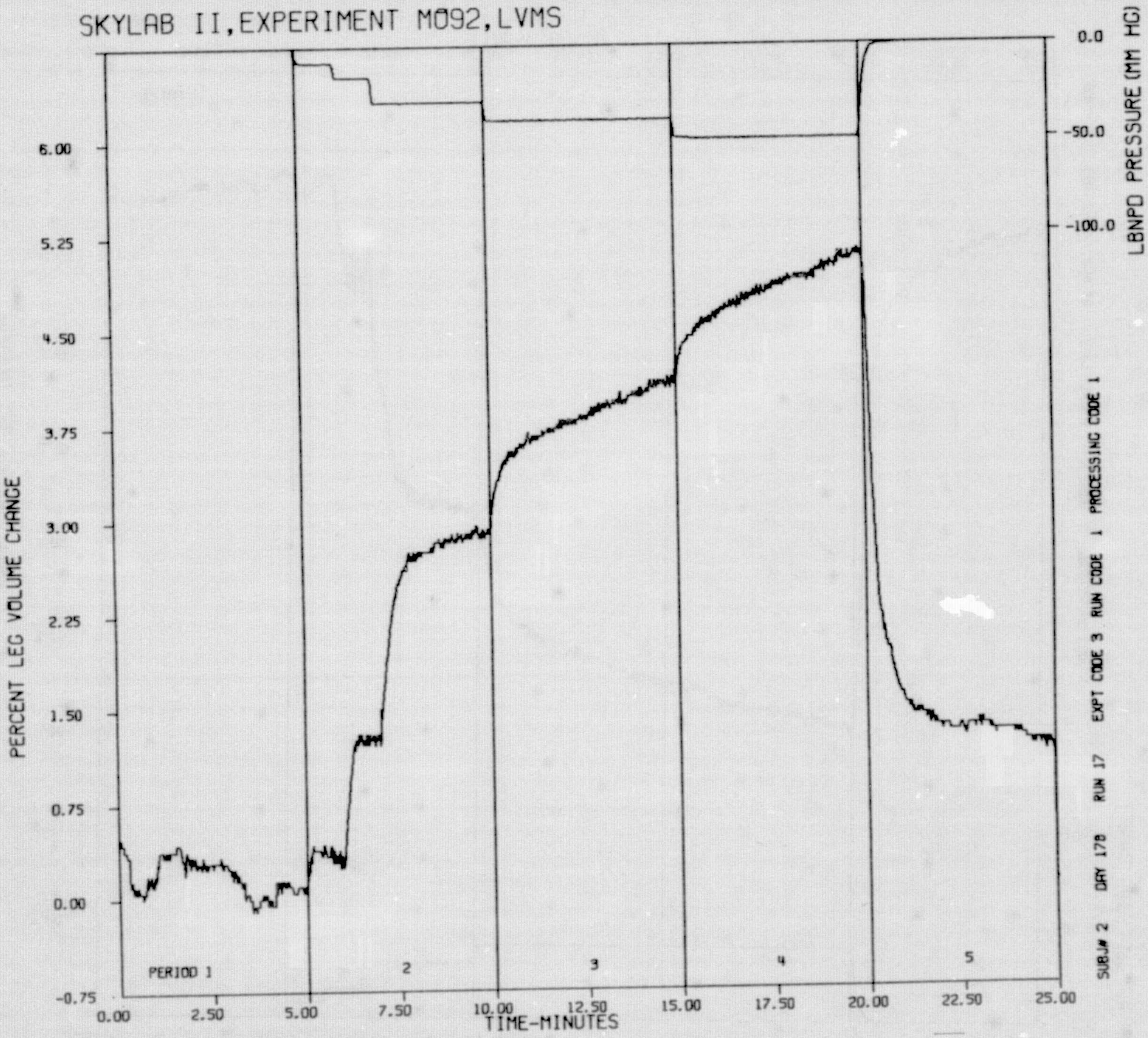


D-36

CALIFORNIA COMPUTER PRODUCTS INC. ANAHEIM, CALIFORNIA CHART NO. C9

CALIFORNIA COMPUTER P

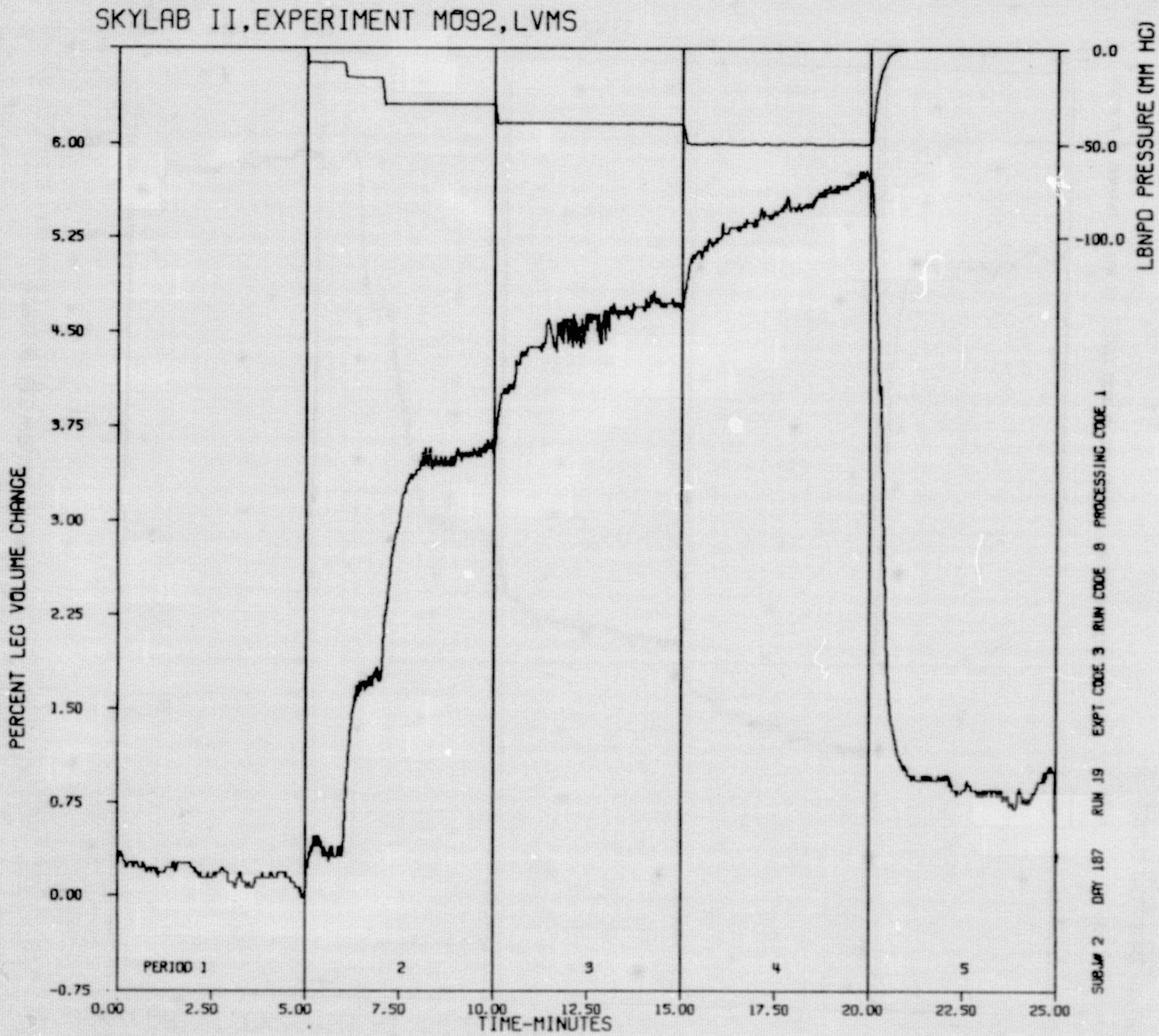

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 175 RUN 16 EXPT CODE 3 RUN CODE 6 PROCESSING CODE 1

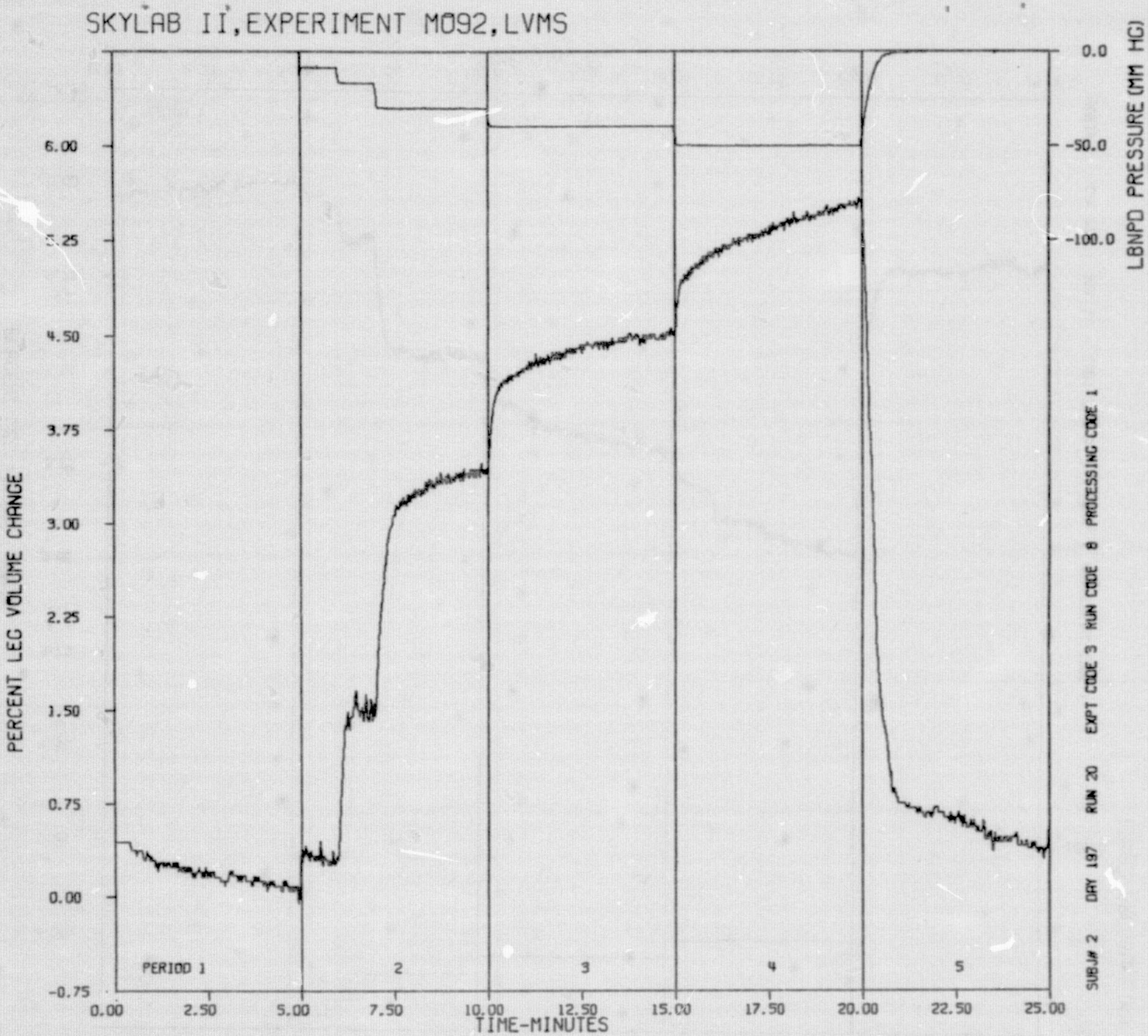


D-38

CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CALIFORNIA CHART NO.

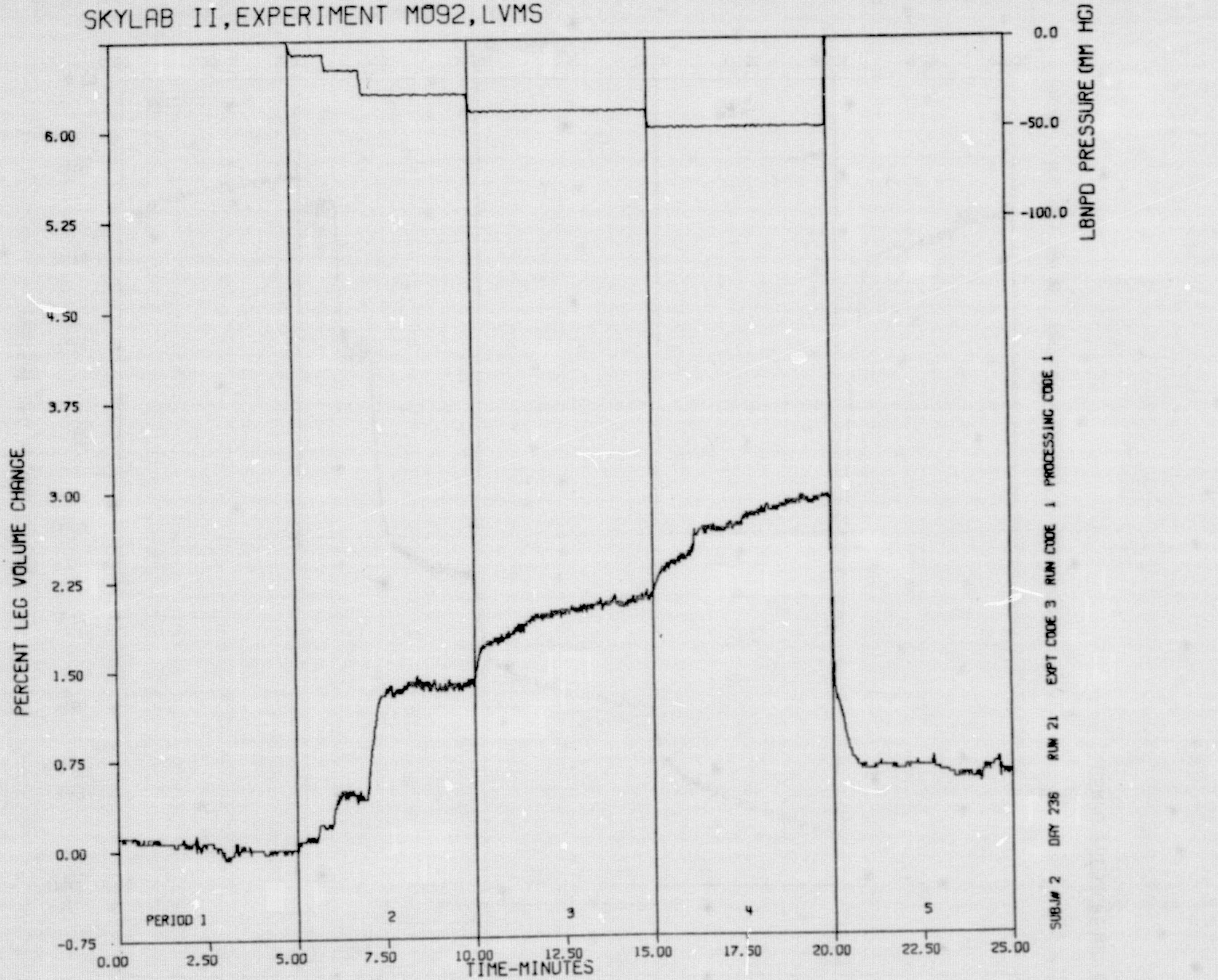
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 181 RUN 18 EXPT CODE 3 RUN CODE 1 PROCESSING CODE 1


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 187 RUN 19 EXPT CODE 3 RUN CODE 8 PROCESSING CODE 1



SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 2 DAY 197 RUN 20 EXPT CODE 3 RUN CODE 8 PROCESSING CODE 1

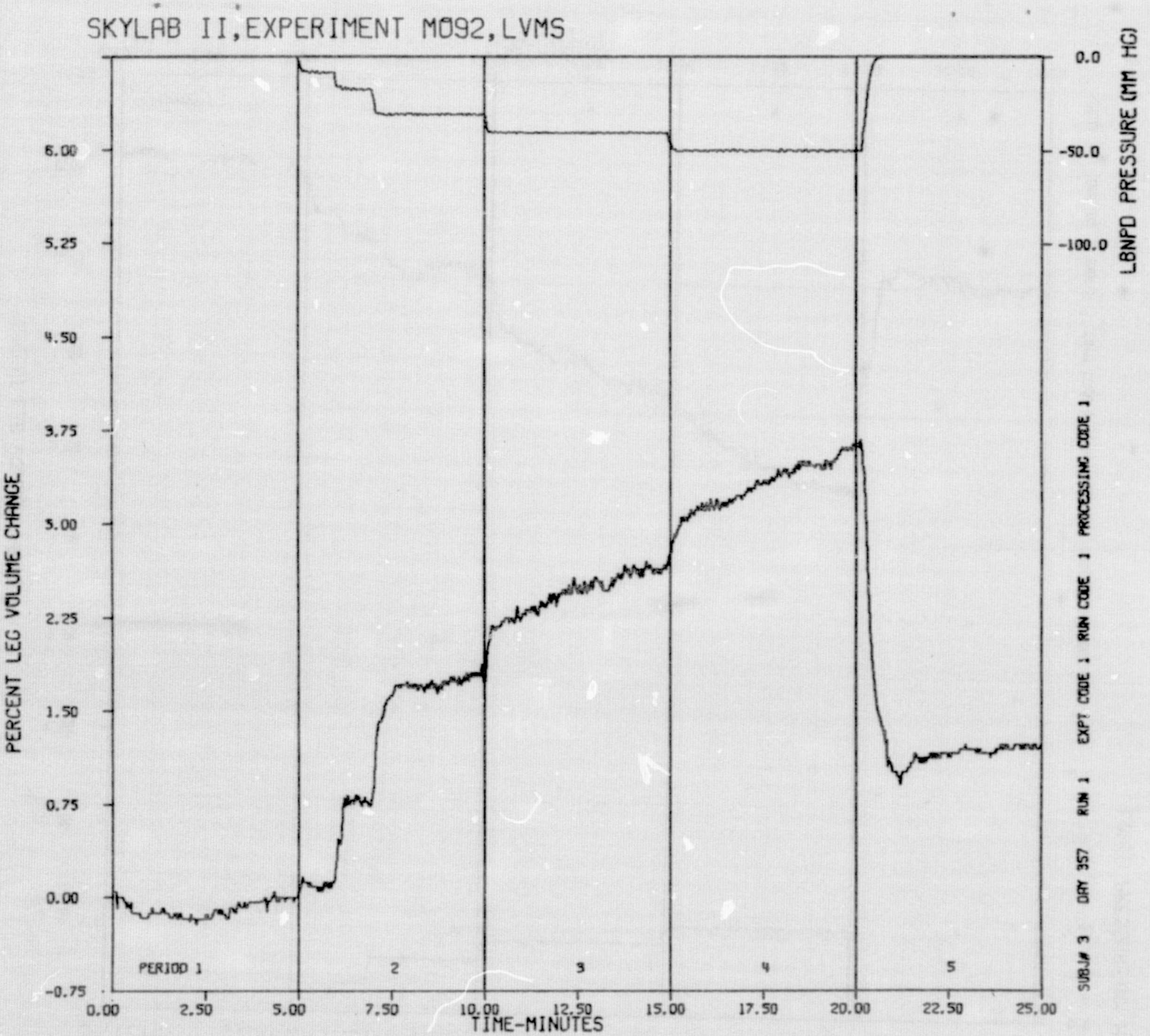
D-41



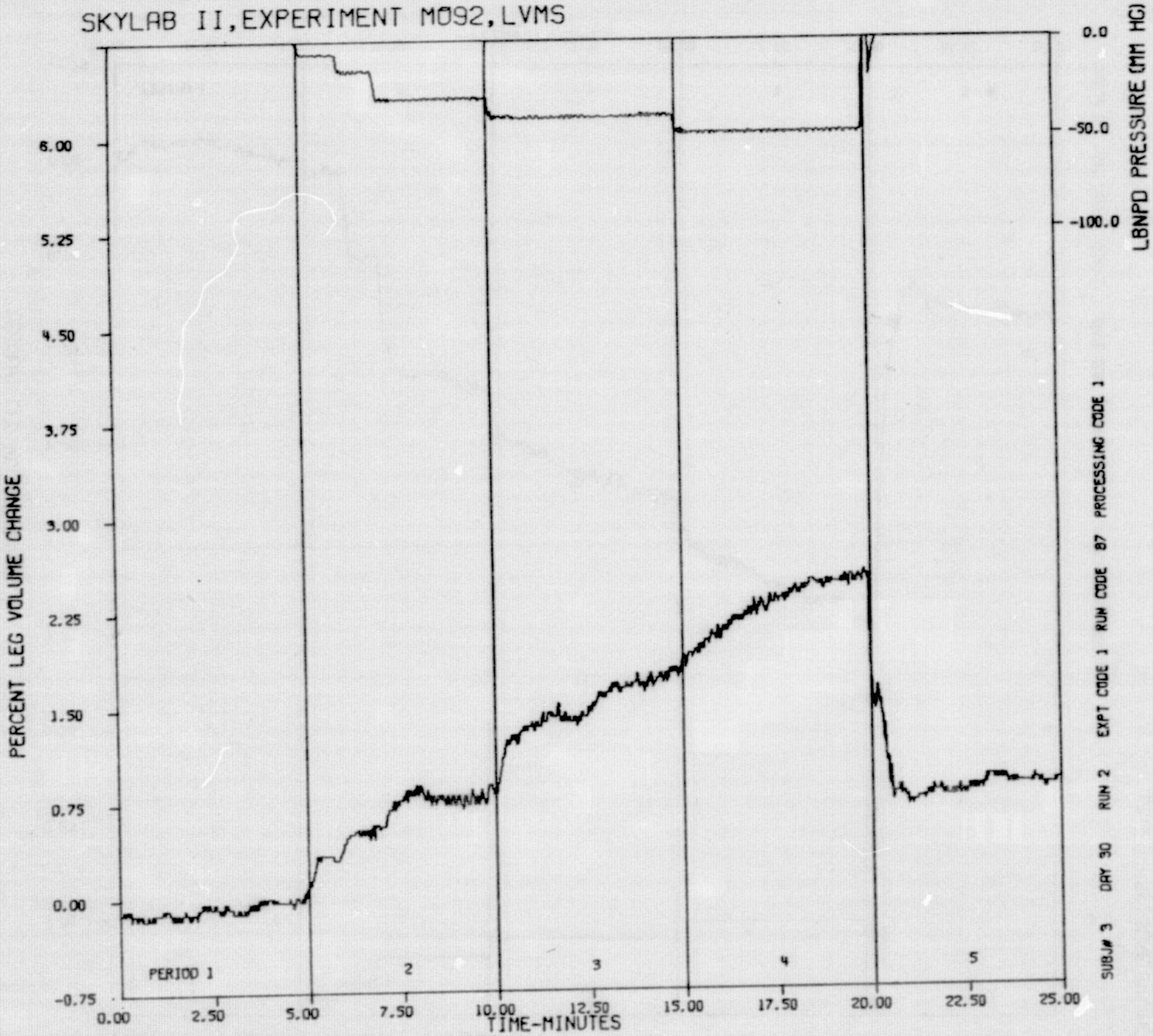
D-42

CALIFORNIA COMPUTER PRODUCTS INC

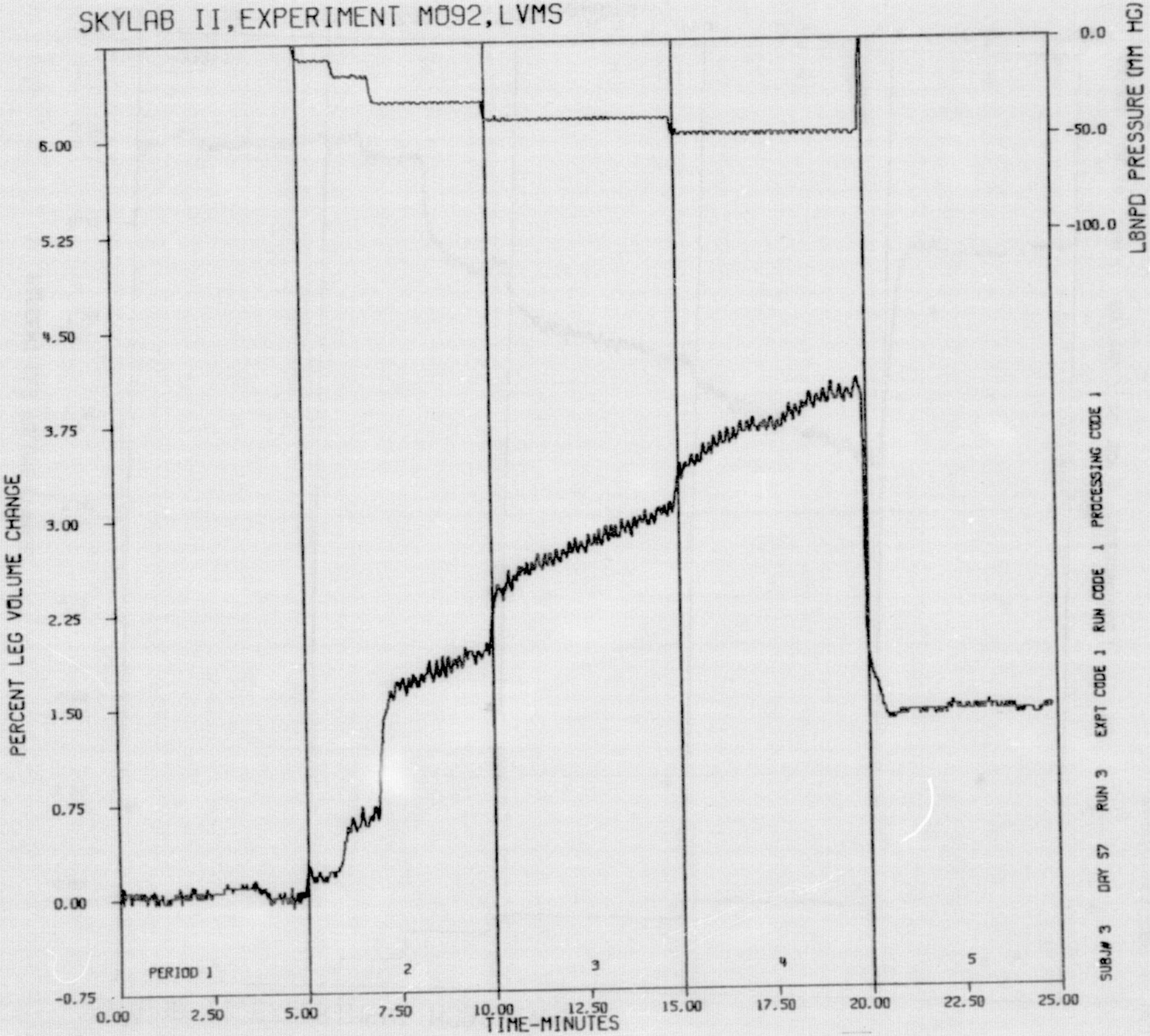
CALIFORNIA COMPUTER PR



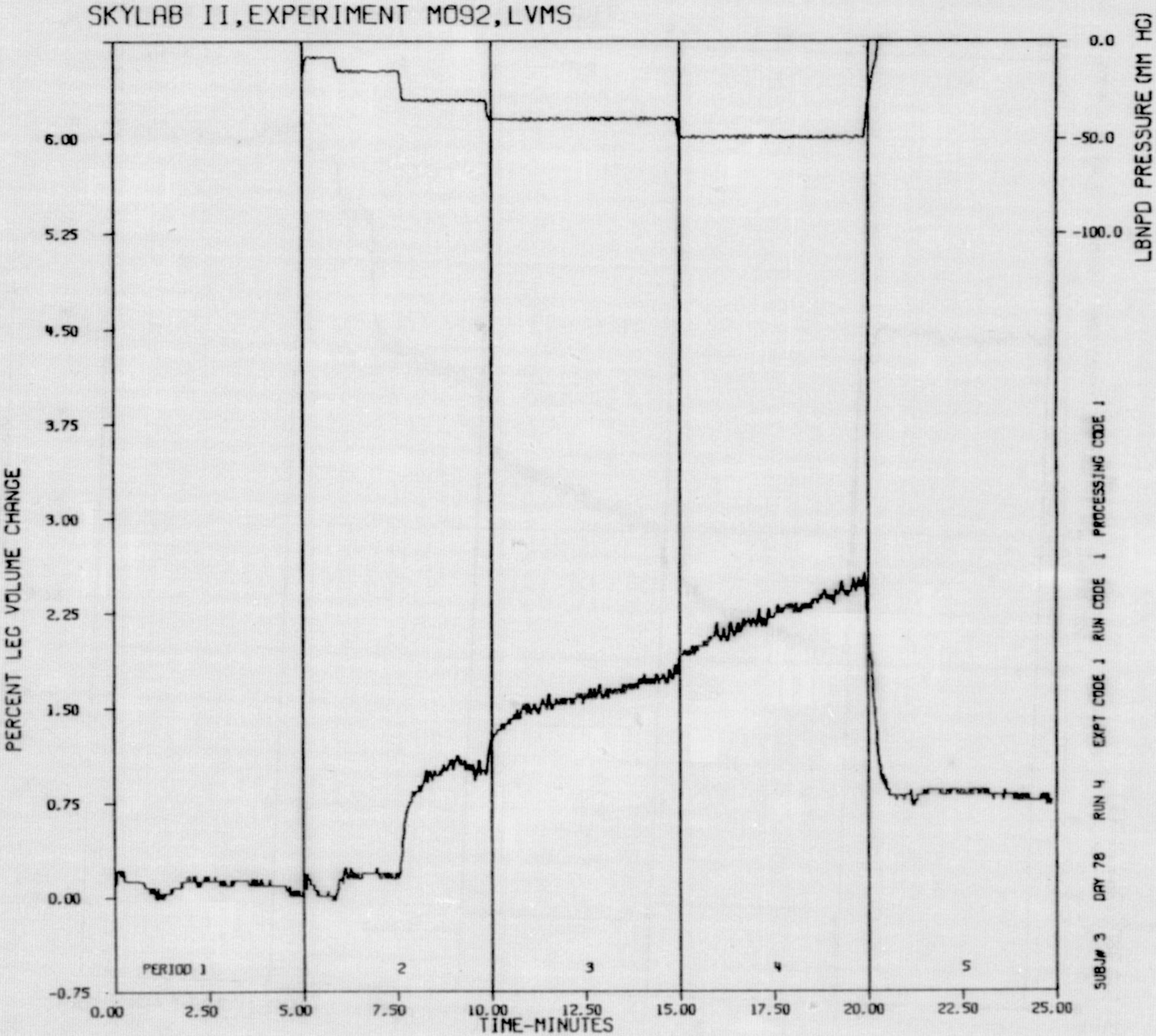
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 357 RUN 1 EXPT CODE 1 RUN CODE 1 PROCESSING CODE 1



SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 30 RUN 2 EXPT CODE 1 RUN CODE 87 PROCESSING CODE 1

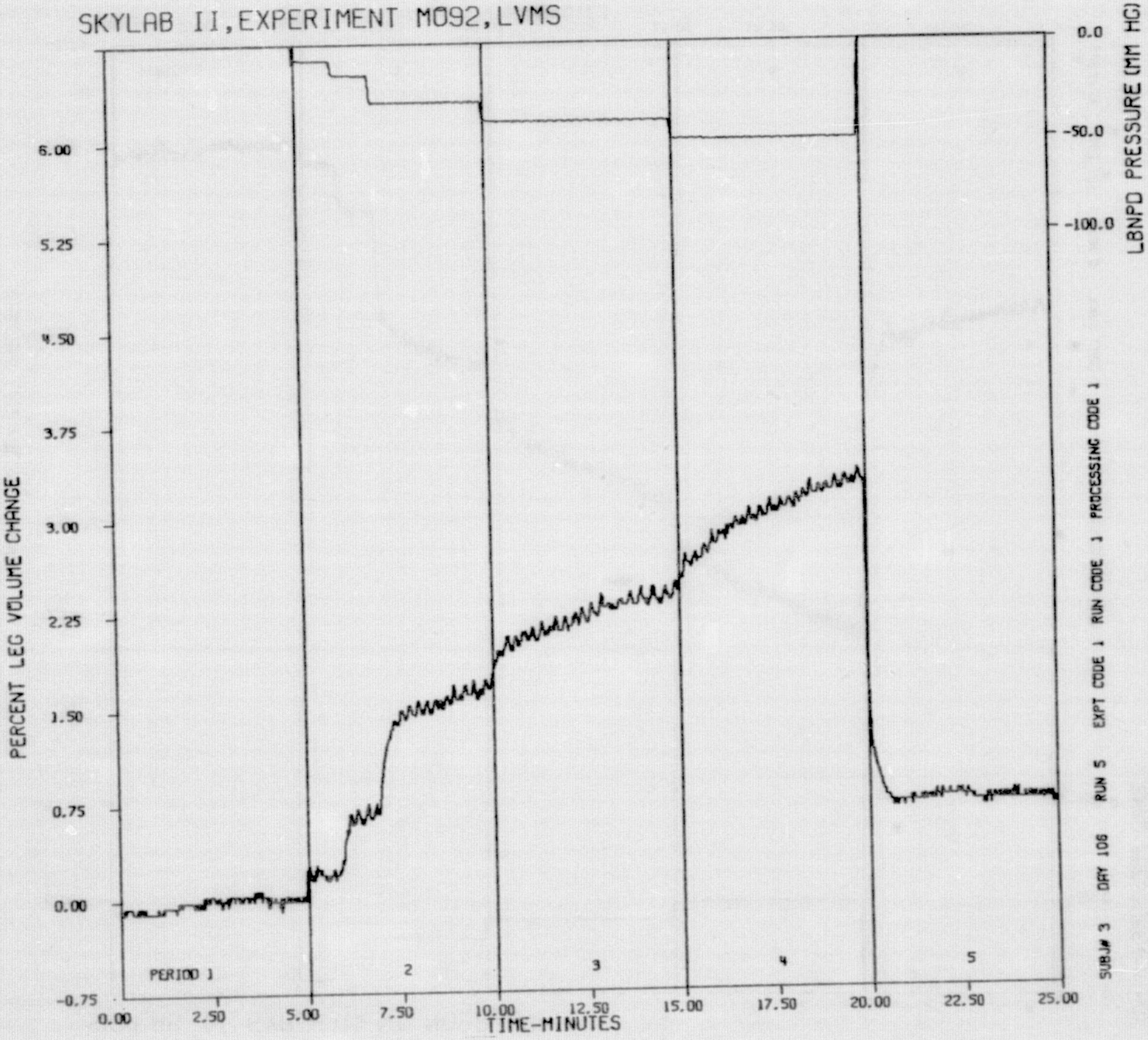

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
TIME-MINUTES
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 57 RUN 3 EXPT CODE 1 RUN CODE 1 PROCESSING CODE 1

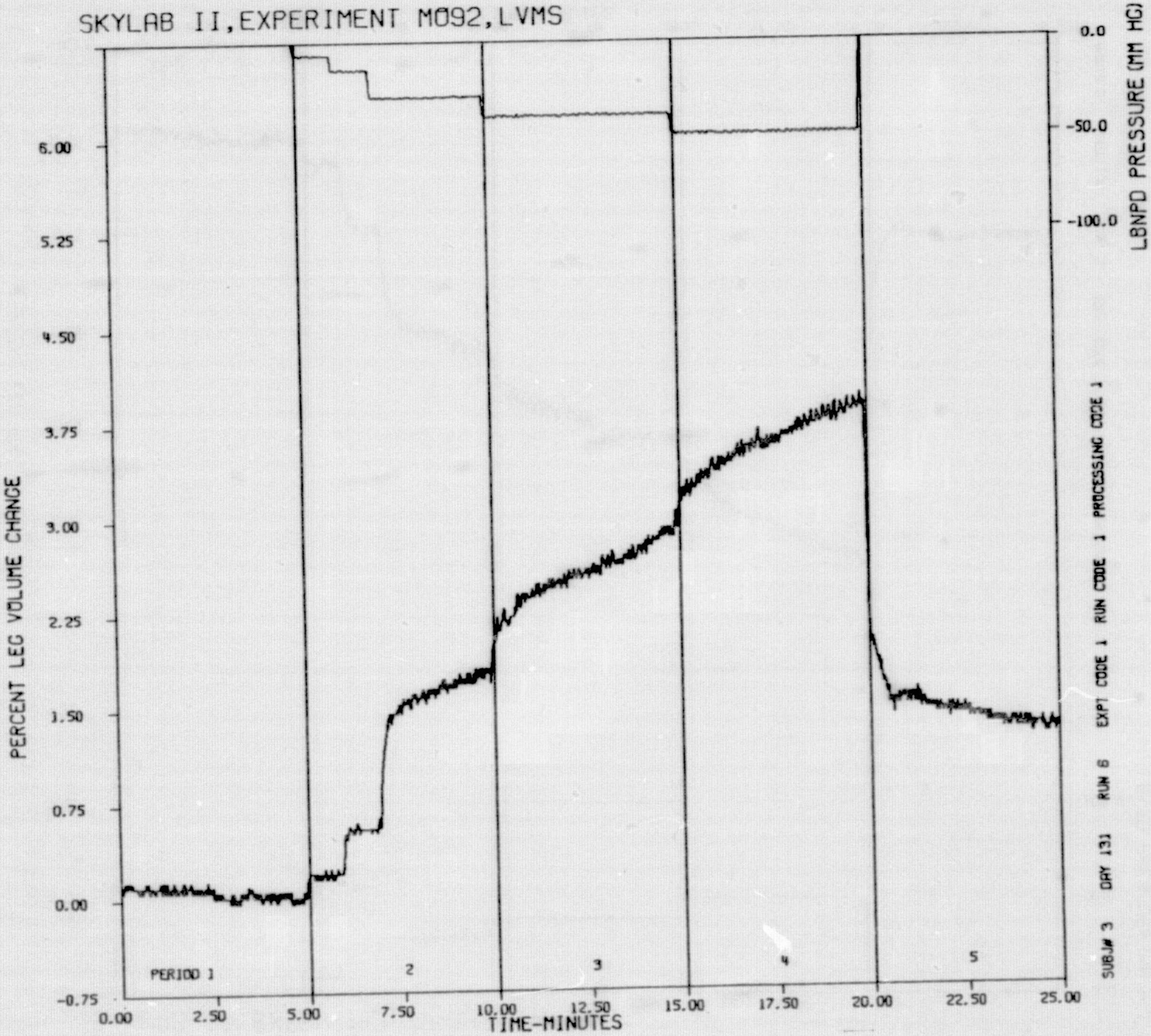
D-45



SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
SUBJ# 3 DAY 78 RUN 4 EXPT CODE 1 RUN CODE 1 PROCESSING CODE 1

D-46

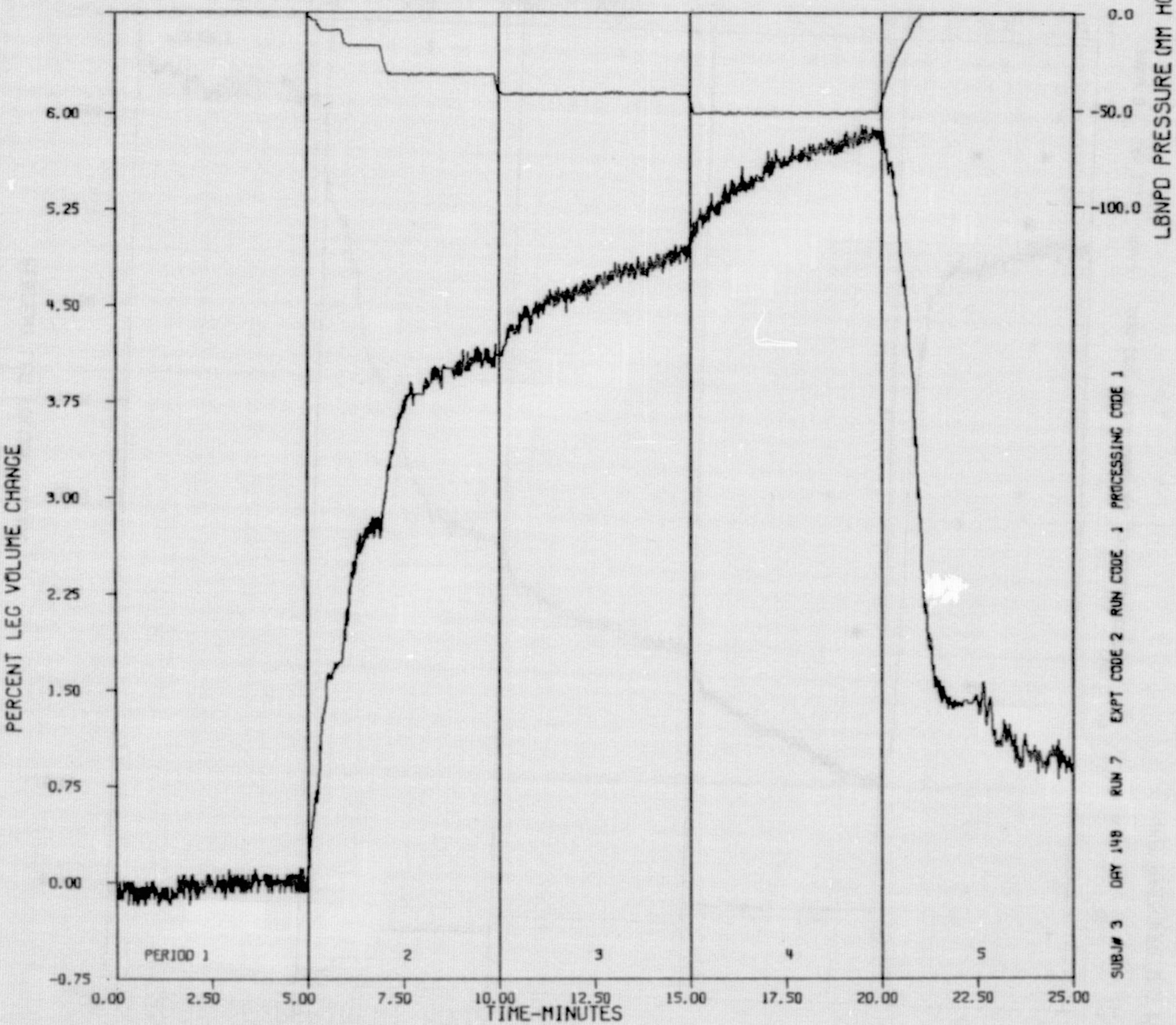

SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
TIME-MINUTES
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 106 RUN 5 EXPT CODE 1 RUN CODE 1 PROCESSING CODE 1



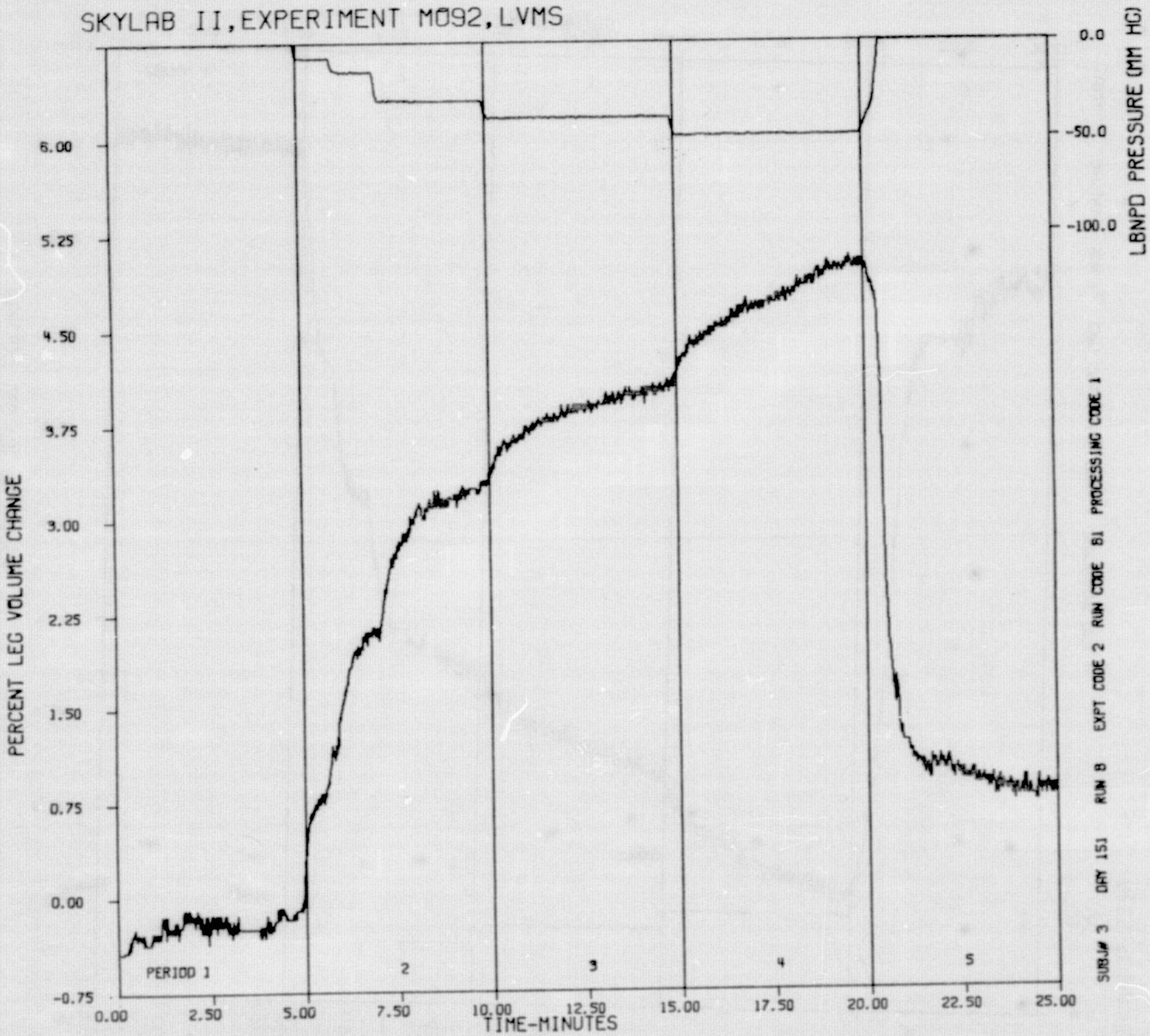
D-48

CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CALIFORNIA CHART NO. 00

SKYLAB II,EXPERIMENT M092,LVMS

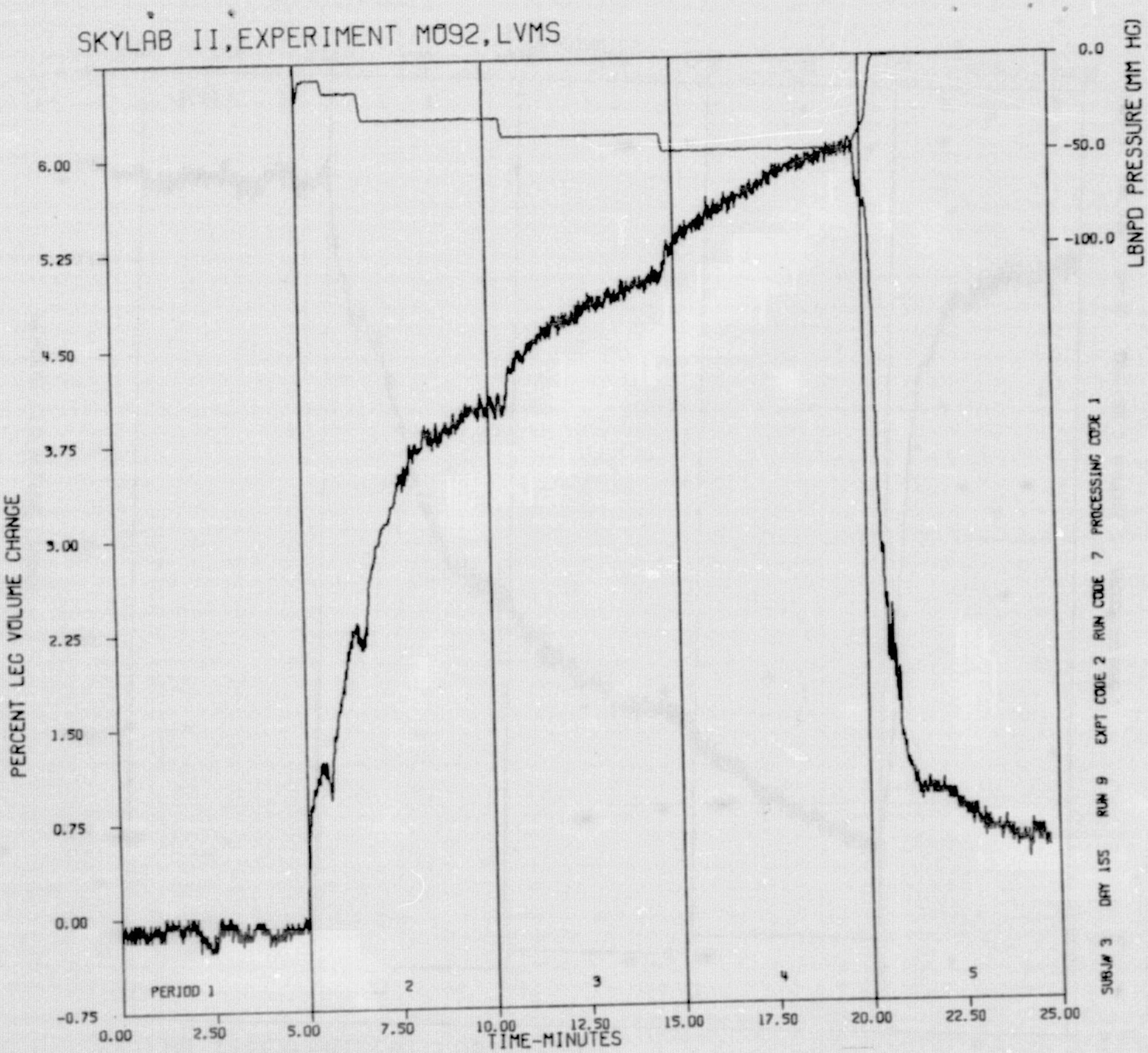


SKYLAB II, EXPERIMENT M092, LVMS



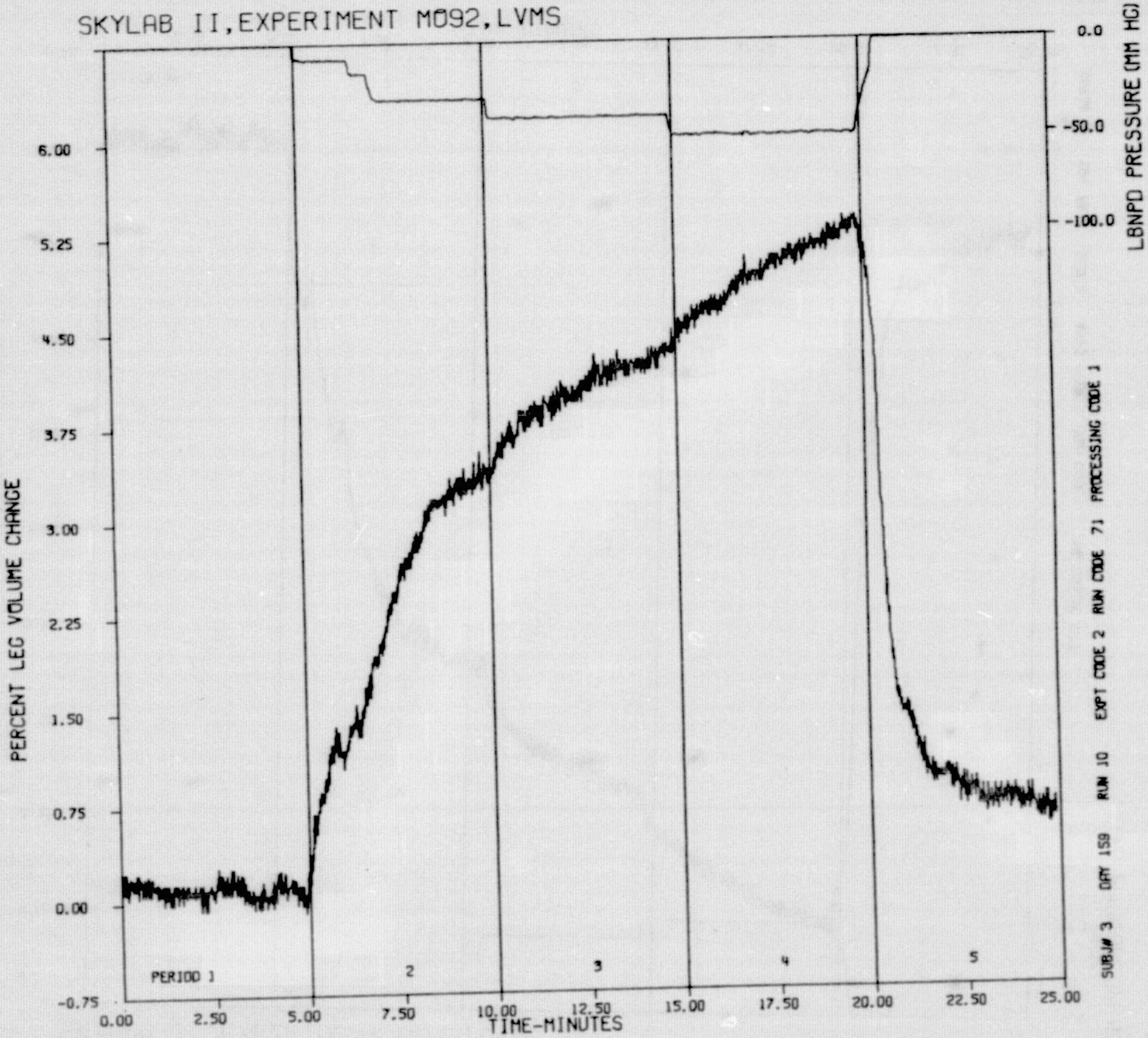
D-50

CALIFORNIA COMPUTER PRODUCTS INC. ANAHEIM, CALIFORNIA CHART NO.00

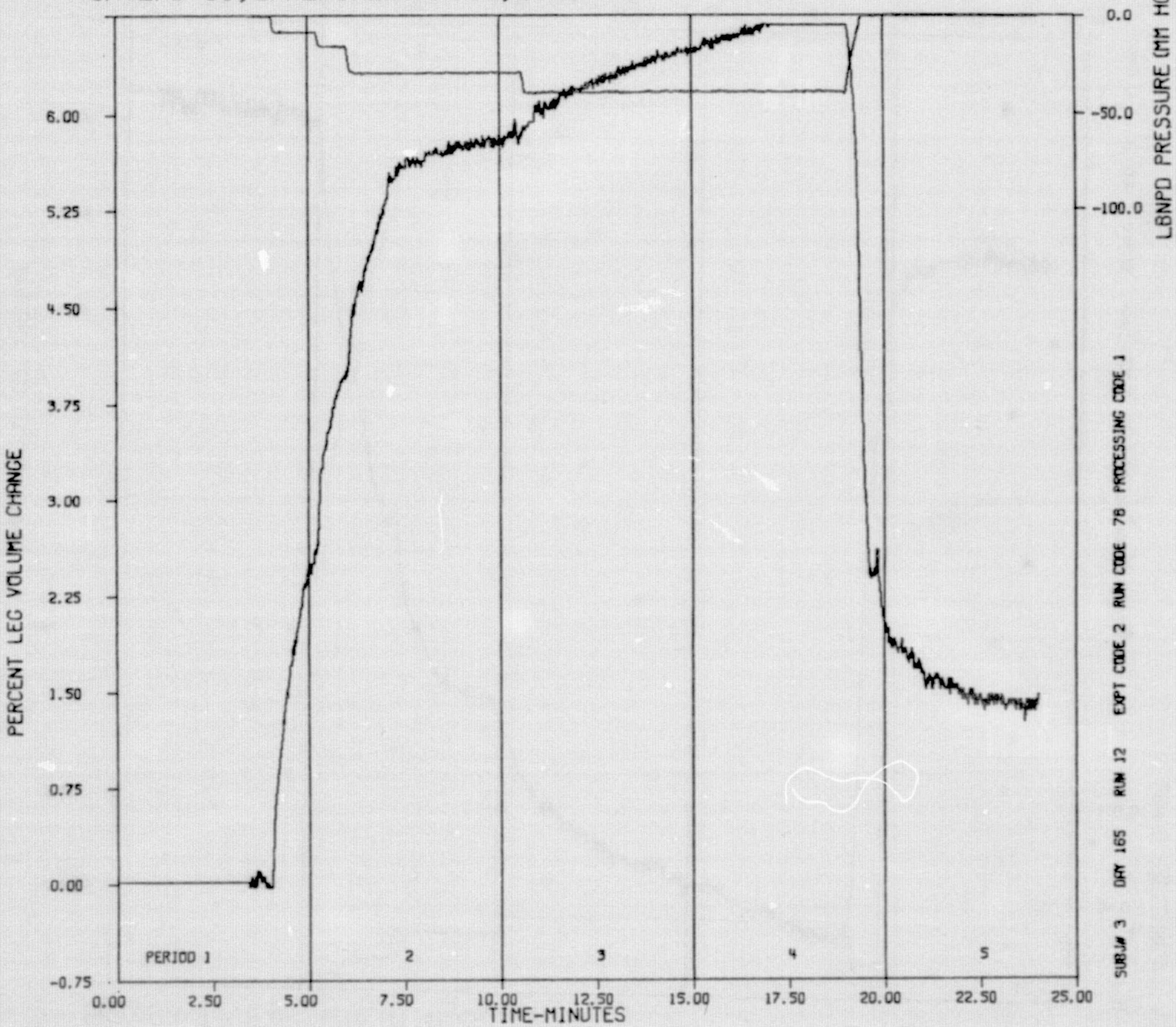


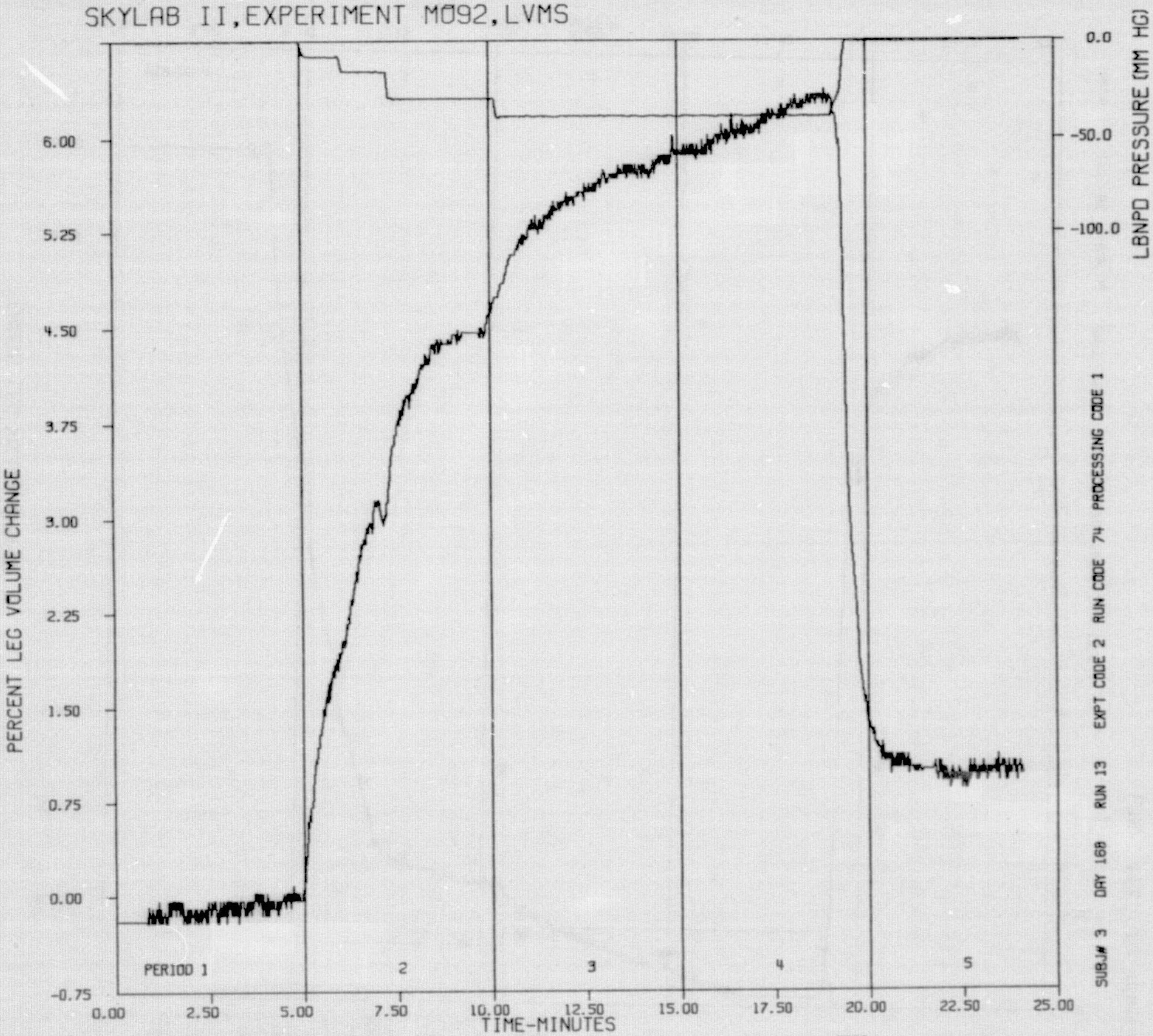
D-51

CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CALIFORNIA CHART NO. 00


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 159 RUN 10 EXPT CODE 2 RUN CODE 71 PROCESSING CODE 1
CALIFORNIA COMPUTER PRODUCTS INC

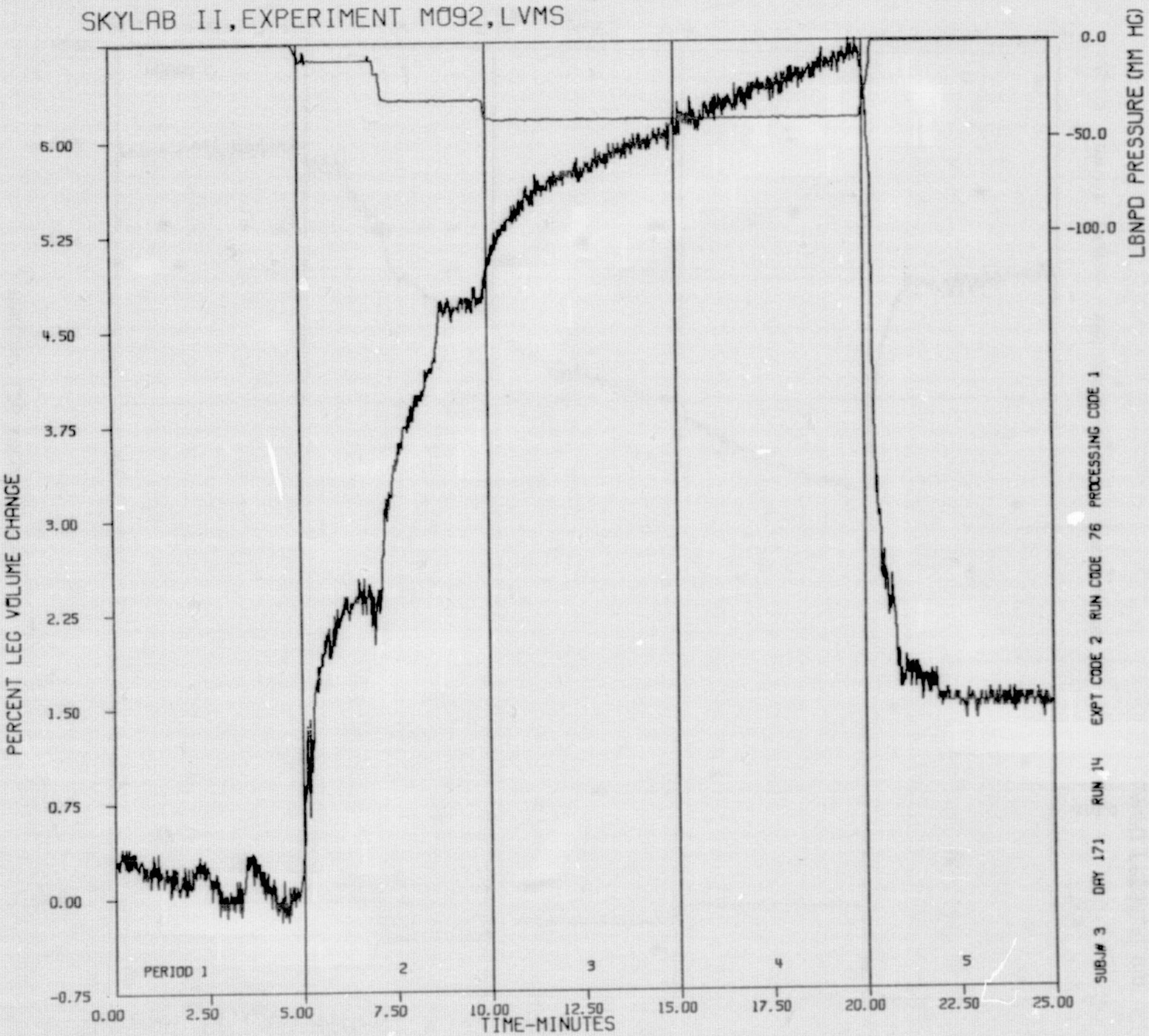
SKYLAB II, EXPERIMENT MØ92, LVMS





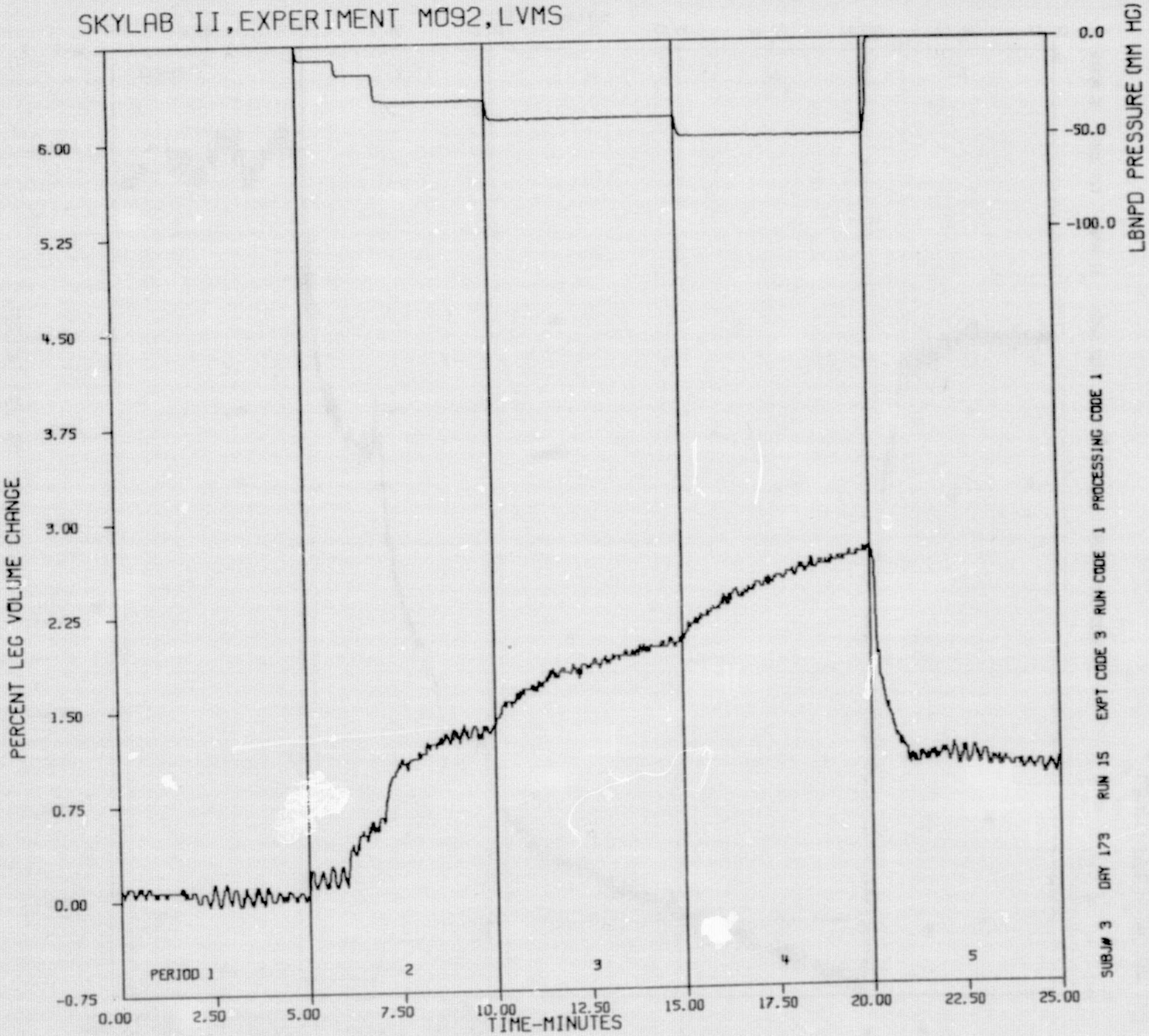
D-54

CHART NO. 00 CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CALIFORNIA CHART NO. 00



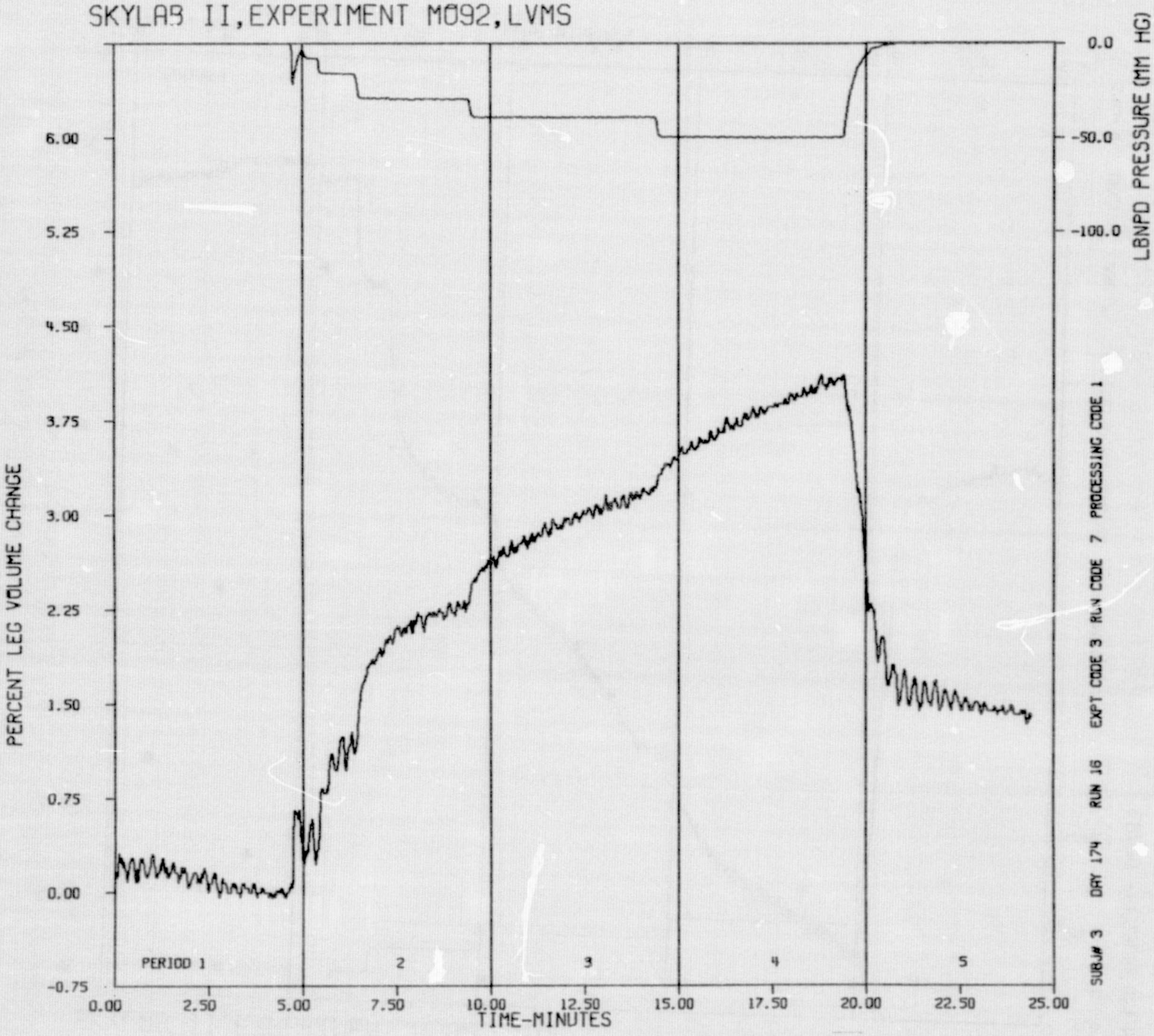
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 171 RUN 14 EXPT CODE 2 RUN CODE 76 PROCESSING CODE 1

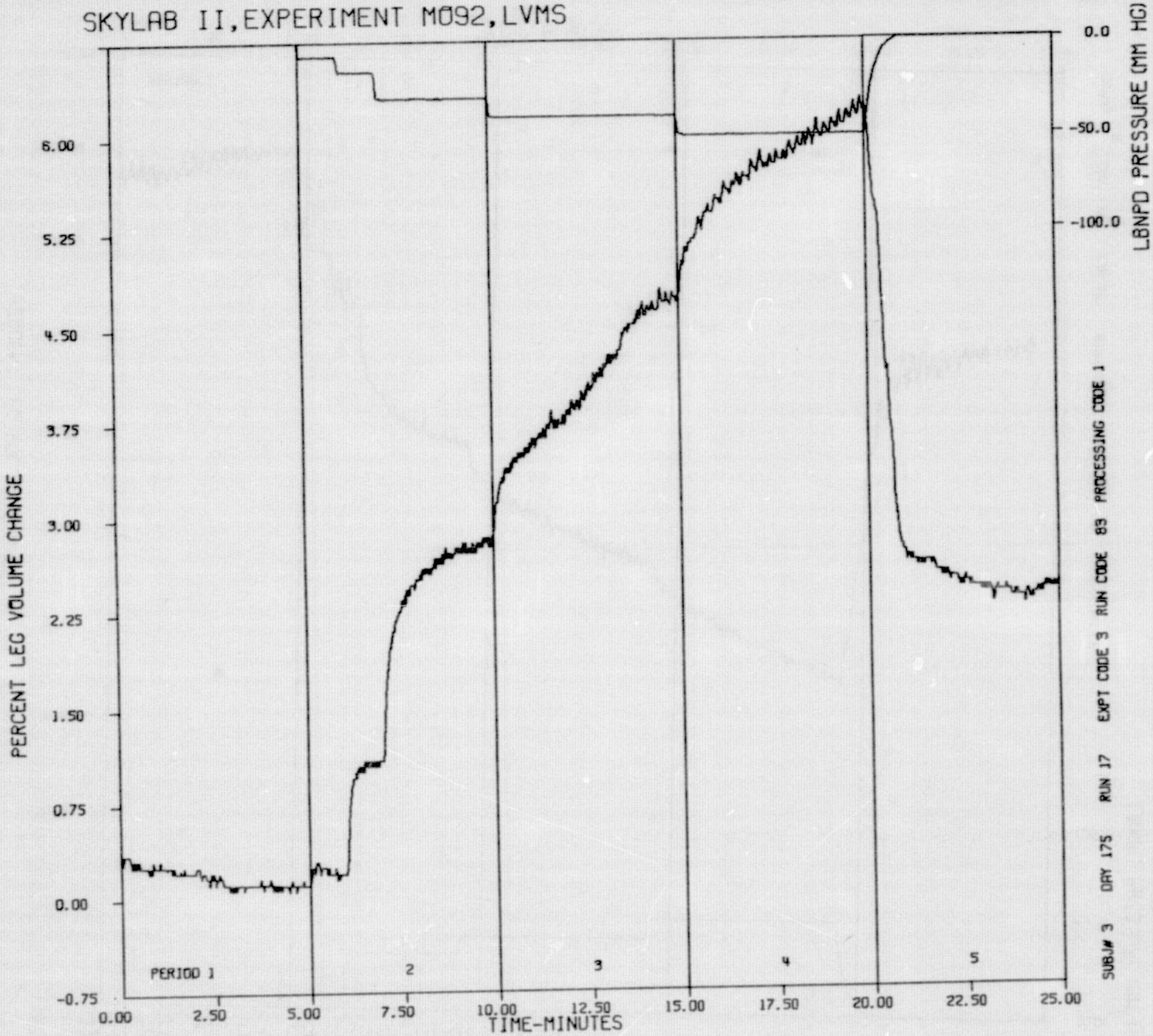
D-55



D-56

CALIFORNIA COMPUTER PRODUCTS, INC. ANAHEIM, CALIFORNIA


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 174 RUN 16 EXPT CODE 3 RUN CODE 7 PROCESSING CODE 1



SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 175 RUN 17 EXPT CODE 3 RUN CODE 83 PROCESSING CODE 1

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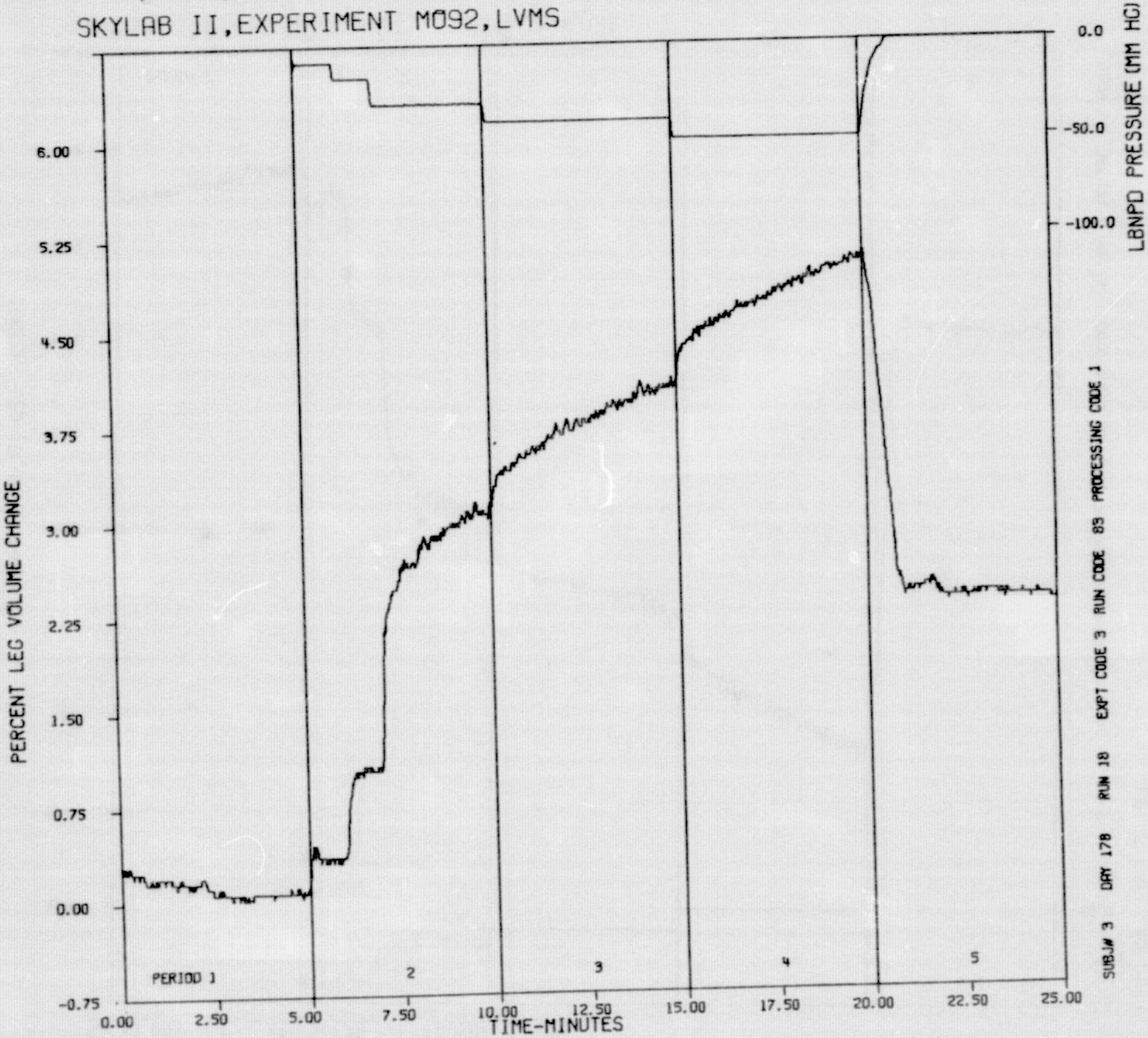
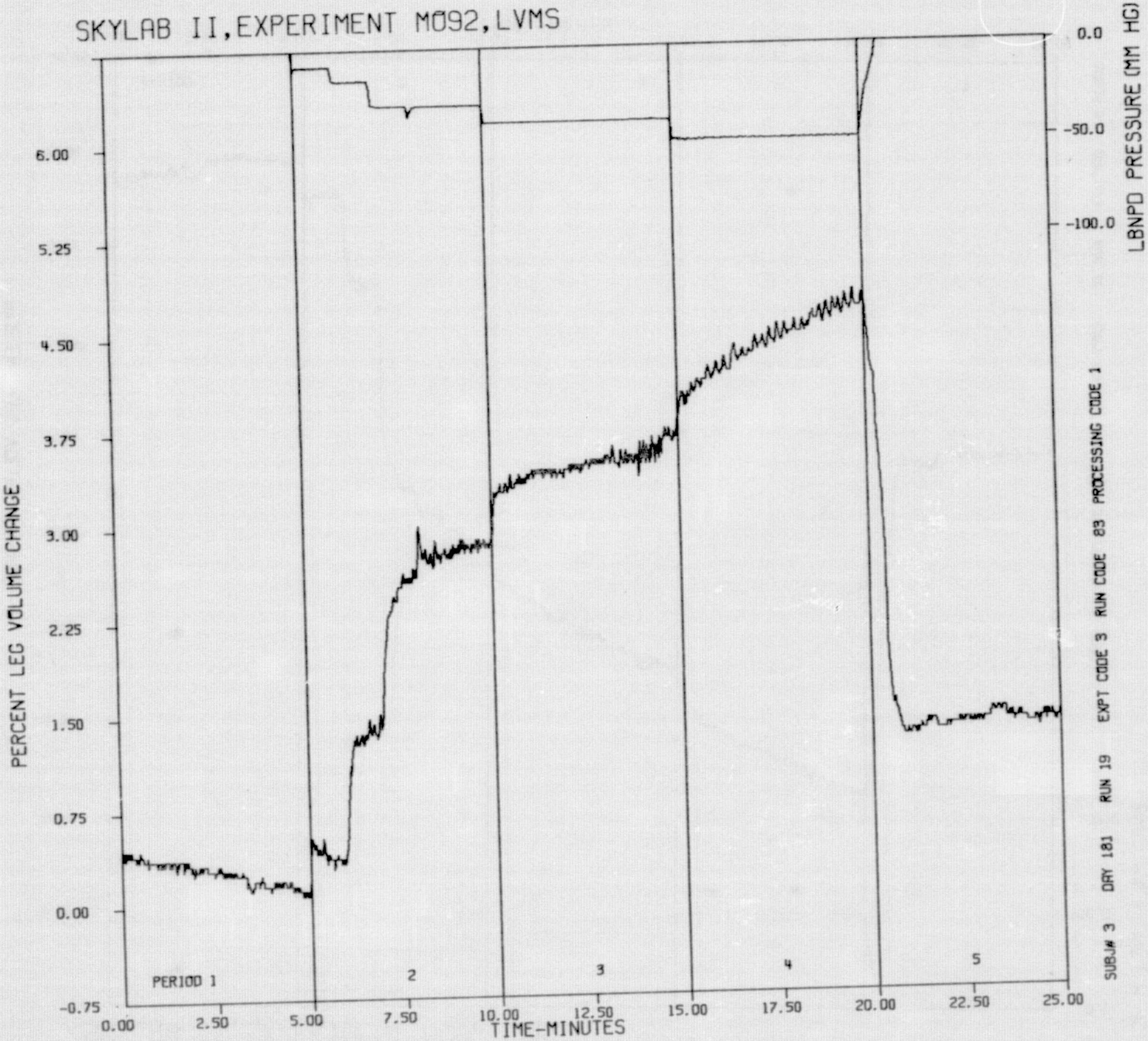


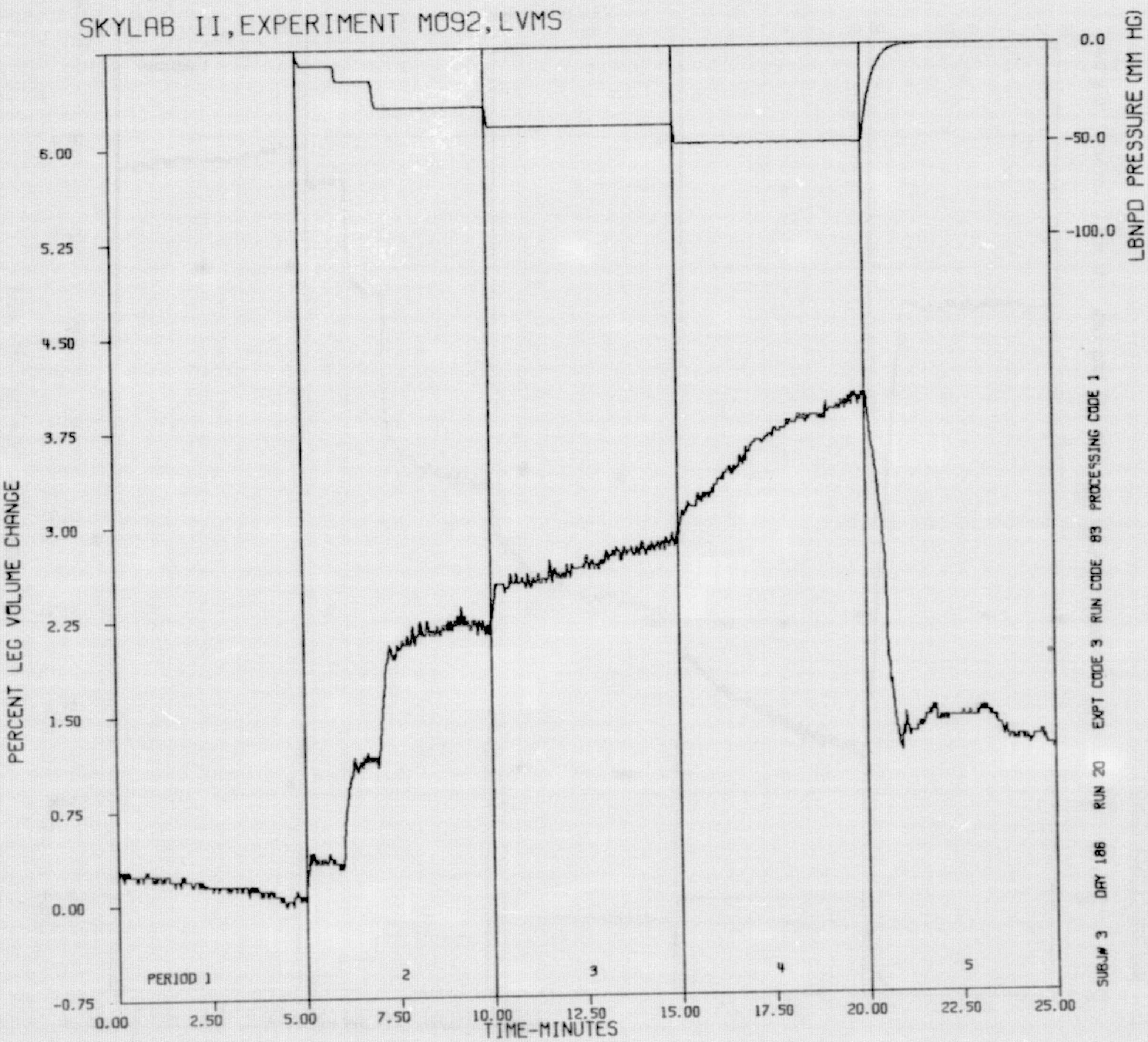
SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
PERIOD 1
2
3
4
5
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
SUBJ# 3 DAY 178 RUN 18 EXPT CODE 3 RUN CODE 83 PROCESSING CODE 1

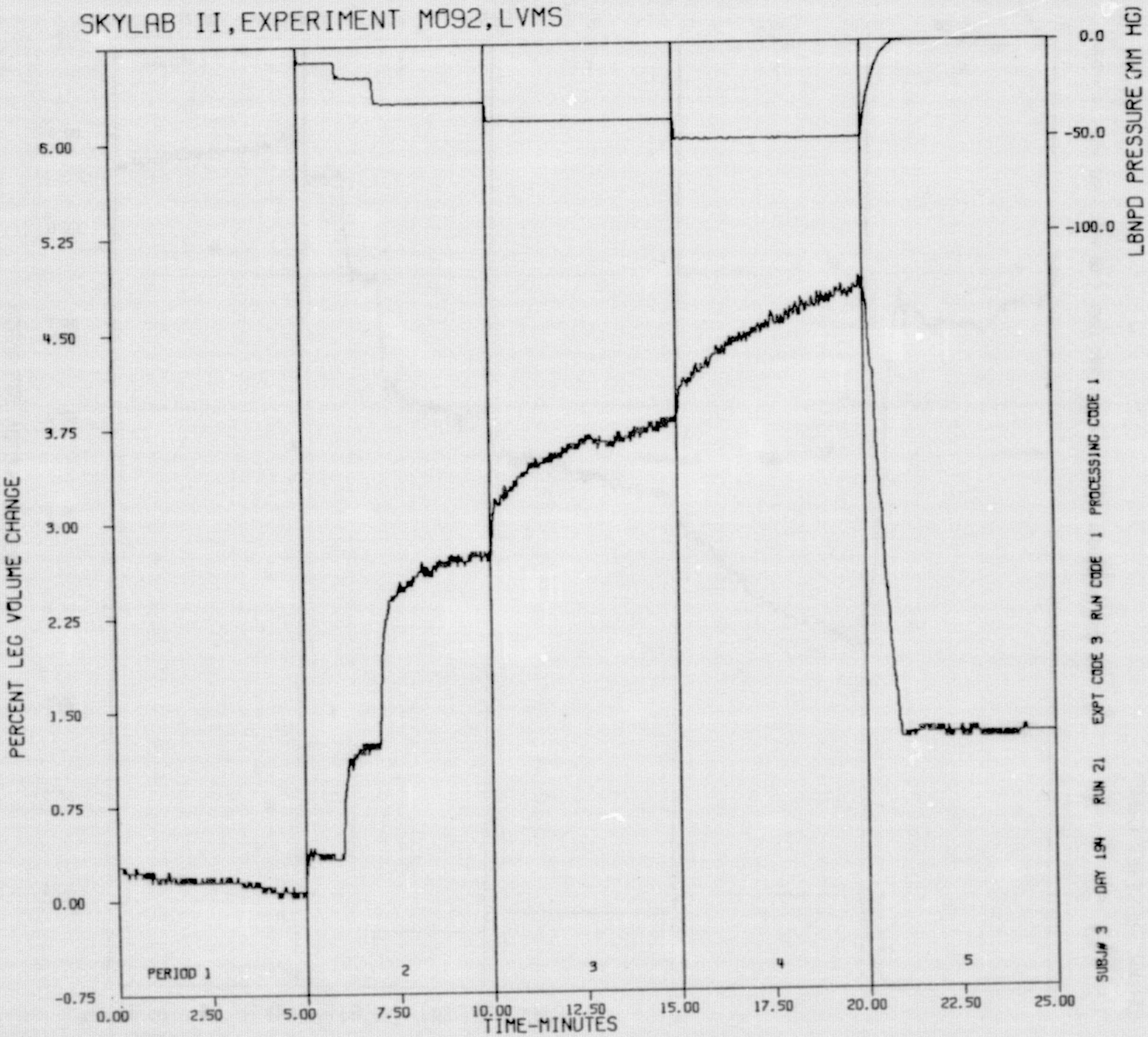
D-59

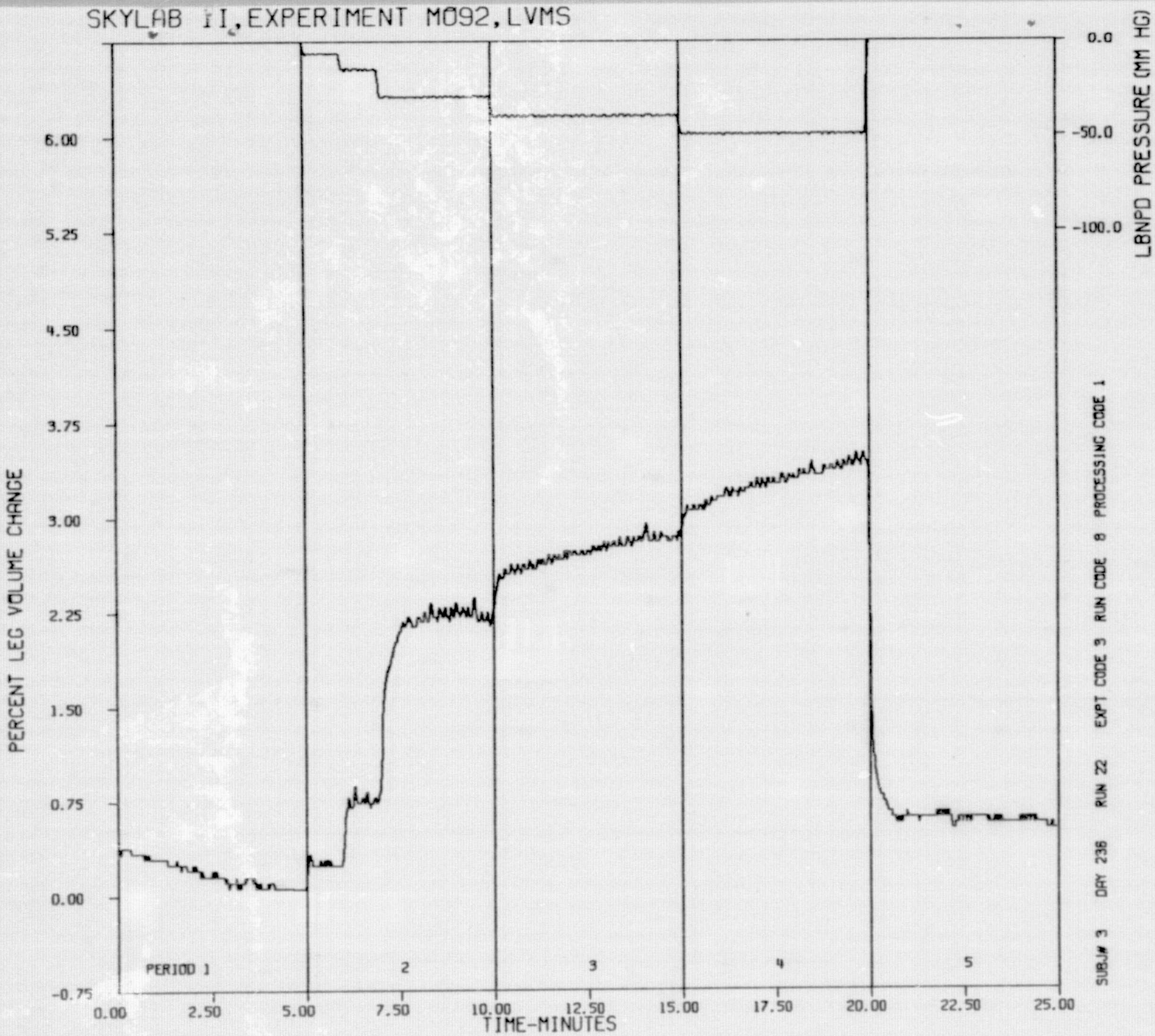


D-60

CALIFORNIA COMPUTER PRODUCT


SKYLAB II, EXPERIMENT M092, LVMS
LBNPD PRESSURE (MM HG)
0.0
-50.0
-100.0
PERCENT LEG VOLUME CHANGE
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
PERIOD 1
2
3
4
5
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
TIME-MINUTES
SUBJ# 3 DAY 186 RUN 20 EXPT CODE 3 RUN CODE 83 PROCESSING CODE 1


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
PERIOD 1
2
3
4
5
0.0
-50.0
-100.0
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
SUBJ# 3 DAY 194 RUN 21 EXPT CODE 3 RUN CODE 1 PROCESSING CODE 1


SKYLAB II, EXPERIMENT M092, LVMS
PERCENT LEG VOLUME CHANGE
LBNPD PRESSURE (MM HG)
TIME-MINUTES
6.00
5.25
4.50
3.75
3.00
2.25
1.50
0.75
0.00
-0.75
0.0
-50.0
-100.0
0.00
2.50
5.00
7.50
10.00
12.50
15.00
17.50
20.00
22.50
25.00
PERIOD 1
2
3
4
5
SUBJ# 3 DAY 236 RUN 22 EXPT CODE 3 RUN CODE 8 PROCESSING CODE 1